WATER & SEWAGE WORKS

MILWAUKEE'S
73-YEAR OLD
WATER TOWER

A GILLETTE

PUBLICATION

A Standard Line with *Special Features* CHAPMAN SLUICE GATES

Many, many sluice gates that once were *special problems* are now in the Chapman *Standard* Line. So, before going to any unnecessary expense in ordering special equipment, be sure first to see what Chapman offers.

And remember, too, Chapman Sluice Gates are simple to install—their interchangeable stems and couplings require no match-marking.

Chapman Sluice Gates may be obtained with any type of operating control—manual, hydraulic cylinder or motor unit.

Send for a copy of Chapman's Sluice Gate Handbook for complete information.

The Chapman Valve Manufacturing Co.

INDIAN ORCHARD, MASSACHUSETTS

WATER AND SEWAGE WORKS, October, 1946, Volume 93, Number 10. Published monthly by Gillette Publishing Co., 22 West Maple St., Chicago 10, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, March 12, 1946, at the Post Office at Chicago, Ill., under act of March 3, 1879.

Announcing the Winners

In The Two Prize Contests That Were Conducted To Stimulate Public Thinking About The Benefits Of

100% METERING

CONTEST NO. 1

(Write the last line to a jingle)

MAJOR PRIZE WINNERS

1st Prize $500.00
Miss Hazel V. Dennis
Baltimore, Md.

2nd Prize $250.00
J. A. Plunkett
Cedar Grove, N. J.

3rd Prize $100.00
David W. Rudolph
Monterey Park, Calif.

4th Prize .....$ 50.00
Fred W. Smith
Gladstone, Ore.

CONSOLATION PRIZES OF $10.00 TO EACH OF THE FOLLOWING:

(Listed Alphabetically)

John H. Angen
New York, N. Y.

R. H. Becker
Las Piedras, Venezuela

Cyrus R. Bird
Chicago, Ill.

Mrs. D. C. Calderwood
Nashua, N. H.

Malcolm E. Condon
Campbell Hall, N. Y.

Mrs. Hazel Crawford
Minoa, N. Y.

Miss Margaret Davis
Maryville, Tenn.

Miss Edith Flynn
Uniontown, Pa.

S. F. Newkirk, Jr.
Elizabeth, N. J.

Craig H. Patterson
Numine, Pa.

Harry S. Roll
Phillips, Texas

H. D. Weller
Berkeley, Calif.

CONTEST NO. 2

(Essay Contest)

MAJOR PRIZE WINNERS

1st Prize $500.00
William W. Hurlbut
Los Angeles, Calif.

2nd Prize $250.00
Mortimer M. Gibbons
Rahway, N. J.

3rd Prize $100.00
Ted H. Kain
Columbia, Pa.

4th Prize .....$ 50.00
S. F. Newkirk, Jr.
Elizabeth, N. J.

CONSOLATION PRIZES OF $10.00 TO EACH OF THE FOLLOWING:

(Listed Alphabetically)

S. L. Brevit
San Francisco, Calif.

Louis H. Goss
Monterey Park, Calif.

R. J. Gulden, Jr.
Dallas, Texas

H. T. Hintgen
Wahpeton, N. Dak.

C. L. Stuart
Moundsville, W. Va.

A. H. Ullrich
Fort Smith, Ark.

S. Leary Jones
Nashville, Tenn.

L. S. Kaiser
Portland, Ore.

Edward Nuebling
New York, N. Y.

S. W. Pratt
Seneca Falls, N. Y.

PITTSBURGH EQUITABLE METER DIVISION
Rockwell Manufacturing Company
PITTSBURGH 8, PA.

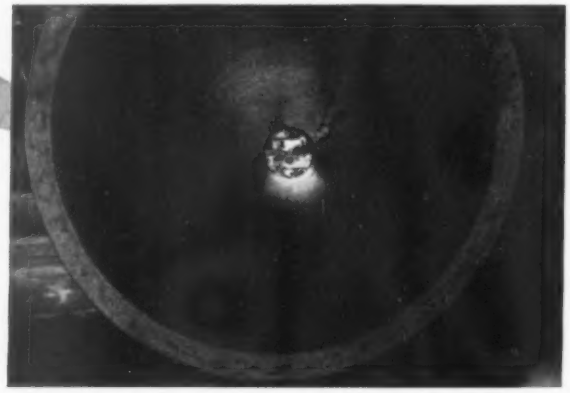
NO-OX-ID Protects Valuable Water Works Property

Water works and sewerage plants provide years of protection for valuable equipment . . . when surfaces are impregnated with NO-OX-ID.

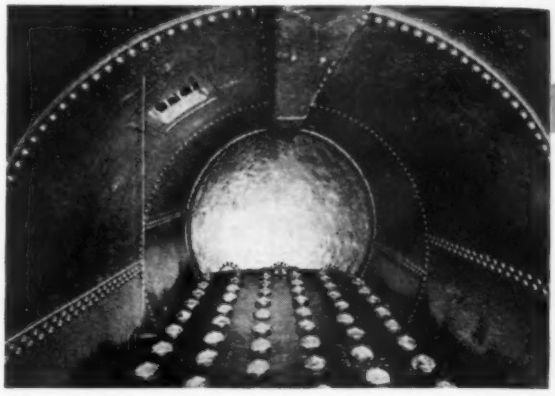
Special consistencies of the resilient, nondrying NO-OX-ID coating are available for application to both metal and concrete surfaces.

The corrosive attacks of water, oxygen, the chemical action of carbon dioxide and corrosive elements are completely routed mechanically by the tough film. Chemical inhibitors prevent underfilm corrosion.

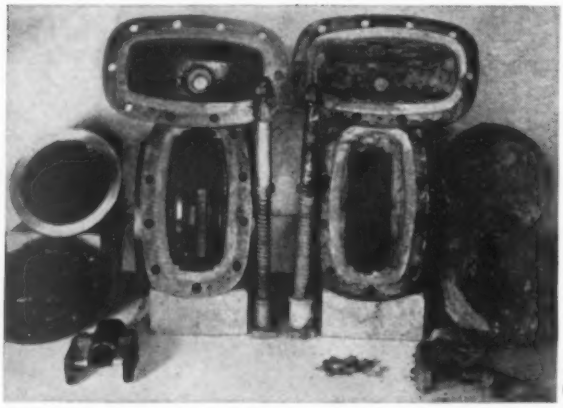
Ask about Water Works NO-OX-ID. Your problem will be surveyed, recommendations made . . . without obligation.



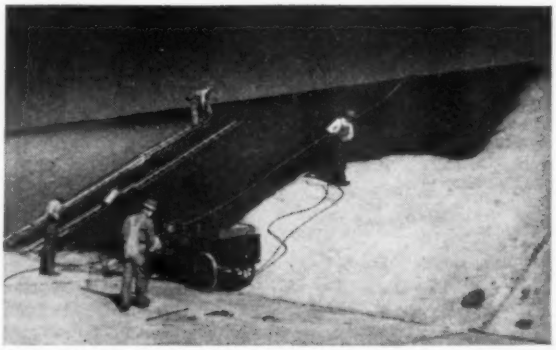
1 *The inside of cast-iron pipe to which NO-OX-ID has been applied. Note smooth surface.*



2 *The inside of a pressure filter after complete reconditioning with NO-OX-ID. One of 36 tanks similarly treated.*



3 *Illustration of valves with thick encrustation of rust and some of the valves after cleaning and NO-OX-ID applied.*



4 *NO-OX-ID applied to concrete basins prevents leakage through joints and cracks, stops cavitation, leaching, etc.*

NO-OX-ID
IRON + OX = RUST
REG. TRADEMARK AUG. 27, 1918

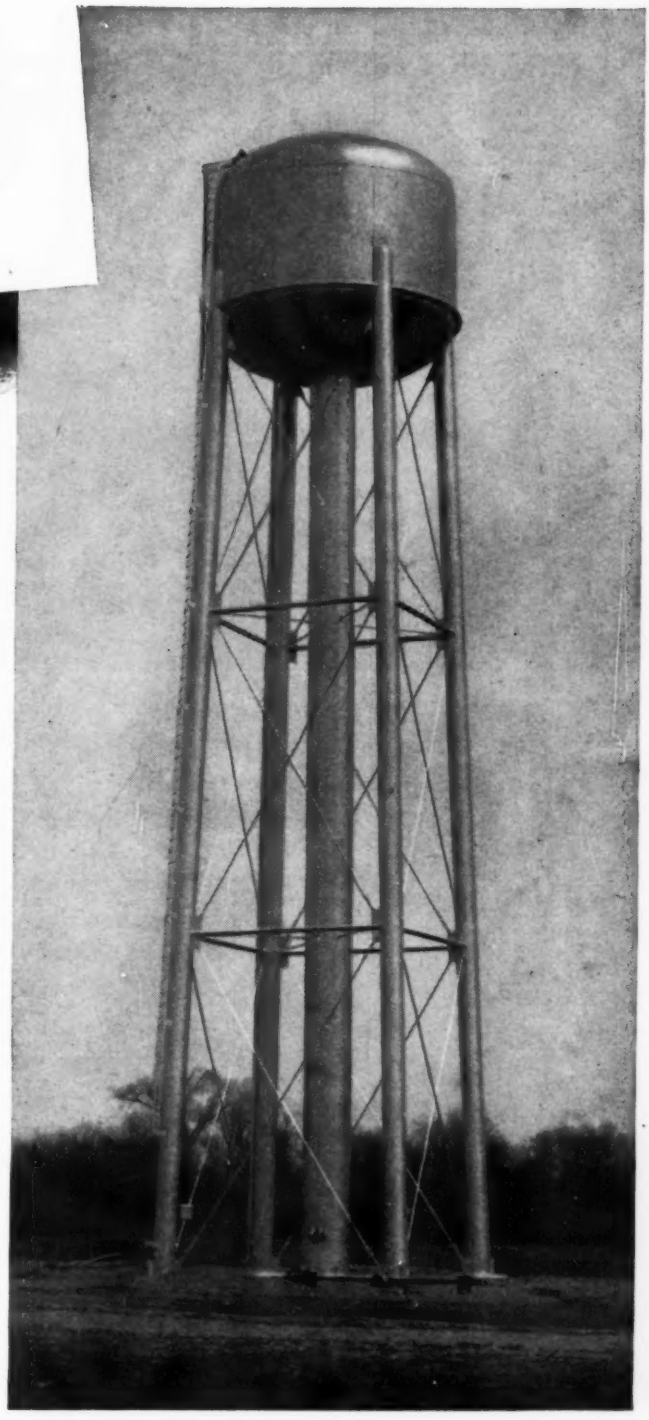
The ORIGINAL RUST PREVENTIVE

DEARBORN CHEMICAL COMPANY
Dept. Y, 310 S. Michigan Ave., Chicago 4, Ill.
New York • Los Angeles • Toronto

the water works engineers for

PITTSFIELD VILLAGE NEAR ANN ARBOR

. . . recommended the installation of this 50,000-gal. Horton ellipsoidal-bottom elevated tank to provide a dependable supply of gravity water in the distribution system. The tank is 80 ft. to bottom, 22 ft. in diam. and has a 4-ft. diam. riser.



WHEN the engineers responsible for the water supply at Pittsfield Village near Ann Arbor, Michigan, recommended Horton elevated storage—they opened the door to many benefits for the water users of that municipality. Elevated storage generally smooths out pressure fluctuations in a water supply system. With adequate storage facilities pumping can be done during off peak periods, thereby lowering pumping costs. Such storage facilities also provide a reserve of water for fire protection.

The Pittsfield village elevated tank is shown at the right. It is located in the center of the village which covers an area of 75 acres. The water is taken from wells located at the pumping station. There are 420 domestic meters in the system. The average daily consumption is 50,000 gals. Two and a half miles of distribution mains, 4 in. and 6 in. in size are used. Water pressure in the system are maintained at 30 lbs. per sq. in.

CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Los Angeles 14.....1455 Wm. Fox Bldg.
Birmingham 1.....1586 North 50th Street
Atlanta 3.....2181 Healey Bldg.
Plants in Birmingham, Chicago and Greenville, Pa.

Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Drive
Philadelphia 3.....1644-1700 Walnut Street Bldg.
Washington 4.....703 Atlantic Bldg.
San Francisco 11.....1283-22 Battery St. Bldg.
Detroit 26.....1551 Lafayette Bldg.
In Canada: Horton Steel Works, Limited, Fort Erie, Ont.

Sludge Fertilizer MAKES VEGETATION GROW AND YIELDS REVENUE FOR SEWAGE PLANTS

When the Rock Falls, Ill. sewage treatment plant installed a Royer Sludge Disintegrator, pictured above, the first use of the sludge fertilizer was on the grounds of the plant. The superintendent writes:

"We covered the grounds with ground sludge cake and sowed grass seed. The growth of vegetation would have to be seen to be appreciated. After we have a surplus of sludge, we intend to pulverize the sludge in our Royer Disintegrator, and sell same for fertilizer."

With commendable caution, this superintendent tested the effectiveness of Royerized sludge as a fertilizer before offering it to the public. However, this information can be obtained from any of the numerous sewage treatment plants equipped with Royers.

The high fertilizing values in sewage sludge have long been known, but it took the Royer to enable sewage plants of every size to produce sludge fertilizer in effective and marketable form.

Sludge cake is shoveled into the hopper of this rugged, inexpensive machine, which does all the rest. Sludge is thoroughly shredded, mixed, aerated and further dried. Sticks and stones are eliminated. The Royer discharges onto pile or truck an effective and ready-to-use fertilizer.

Sewage plants with Royers find a ready market (often cash-and-carry) for their fertilizer, especially among florists, greenskeepers and truck gardeners.

Twelve models — electric motor, gasoline engine or belt-to-tractor driven. Write for our Sewage Sludge Utilization Datalog.

ROYER

PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.

170 PRINGLE ST., KINGSTON, PA.

Attendance goes up when swimmers find a "good" pool with clean water that "feels" right and won't irritate eyes and nose. Be sure your pool is a "good" pool . . . get Sanitation HTH, the dry, free-flowing chlorine-carrier that contains over 70% available chlorine. Sanitation HTH retains its strength . . . protects pool water and entire premises from germs and odors . . . prevents the formation of slippery, unsightly algae growth. And to control alkalinity get PH-Plus, the fused alkali in convenient cake form. *The Mathieson Alkali Works (Inc.), 60 East 42nd Street, New York 17, N. Y.*

THIS 6 POINT PLAN IS THE MODERN WAY TO KEEP A POOL SAFE AND SANITARY:

1. **Use HTH to keep pool water safe.**
2. **Use HTH to guard against athlete's foot.**
3. **Use HTH to keep pool surroundings (beaches, pavement) sanitary.**
4. **Use HTH for bleaching and sterilizing towels.**
5. **Use HTH for pool cleaning and algae control.**
6. **Use PH-Plus for alkalinity control.**

Sanitation HTH is available in cases of nine 5-lb. cans and in 100-lb. drums; PH-Plus in 100-lb. bags.

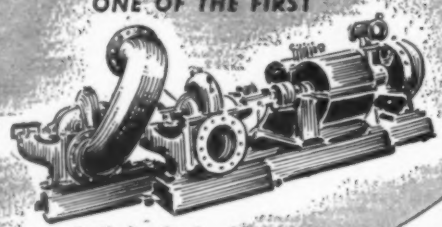
Mathieson
SANITATION HTH

Sanitation HTH . . . Chlorine Dioxide . . . PH-Plus (Fused Alkali) . . . Caustic Soda . . . Soda Ash . . . Bicarbonate of Soda . . . Ammonia, Anhydrous & Aqua . . . Dry Ice . . . Carbonic Gas . . . Synthetic Salt Cake . . . Sodium Chlorite Products . . . Sodium Methylate

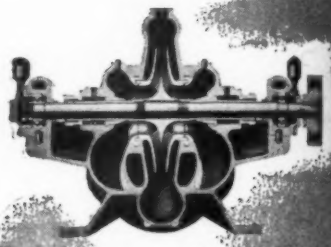
WRITE FOR FREE 48-PAGE BOOKLET "KEEPING THE POOL SAFE AND SANITARY"

45 Years of PUMP IMPROVEMENT

ONE OF THE FIRST

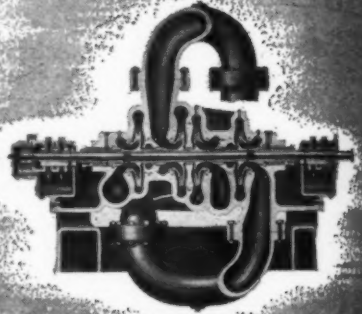


Built by De Laval in 1902

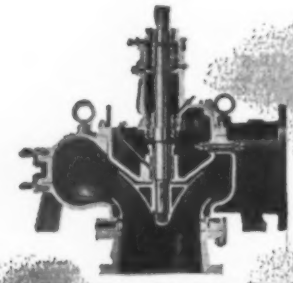


SINGLE STAGE, DOUBLE SUCTION PUMP

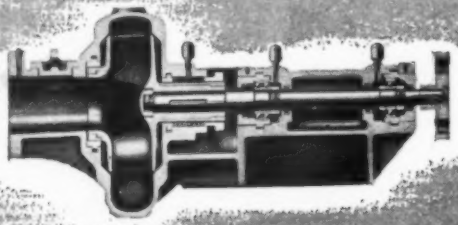
Modern De Laval centrifugal pumps represent the culmination of more than 45 years of continual improvement and perfection. This long period of concentration upon the problems of centrifugal pump design and application places at the user's command a complete line of modern, high quality pumps and a vast store of knowledge concerning pump application problems.



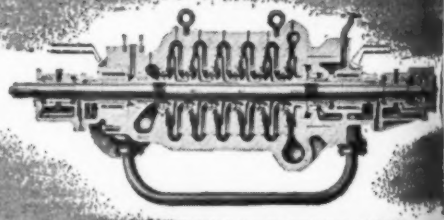
FOUR STAGE, OPPOSED IMPELLER PUMP



MIXED FLOW PUMP



CLOGLESS PUMP



HIGH PRESSURE, MULTI-STAGE PUMP

GA-1

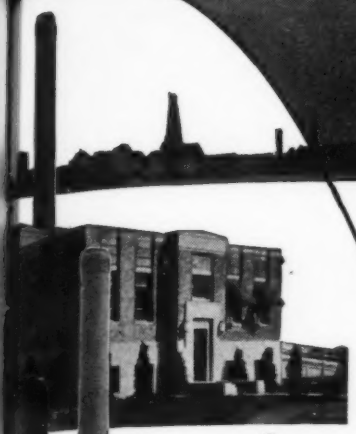
TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY
TRENTON 2, NEW JERSEY

SALES OFFICES: ATLANTA • BOSTON • CHARLOTTE • CHICAGO • CLEVELAND • DENVER • DETROIT • DULUTH • EDMONTON • GREAT FALLS • HAVANA • HELENA • HOUSTON • KANSAS CITY • LOS ANGELES • MONTREAL
NEW ORLEANS • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE • TORONTO • TULSA • VANCOUVER • WASHINGTON, D. C. • WINNIPEG

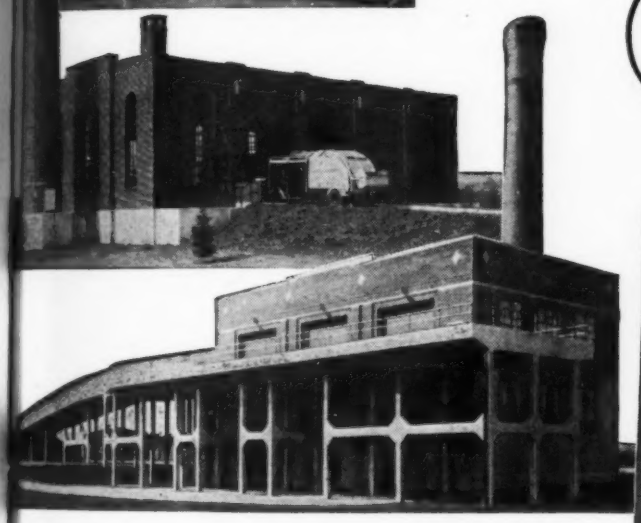
IS GARBAGE AND RUBBISH DISPOSAL A PROBLEM IN YOUR COMMUNITY?

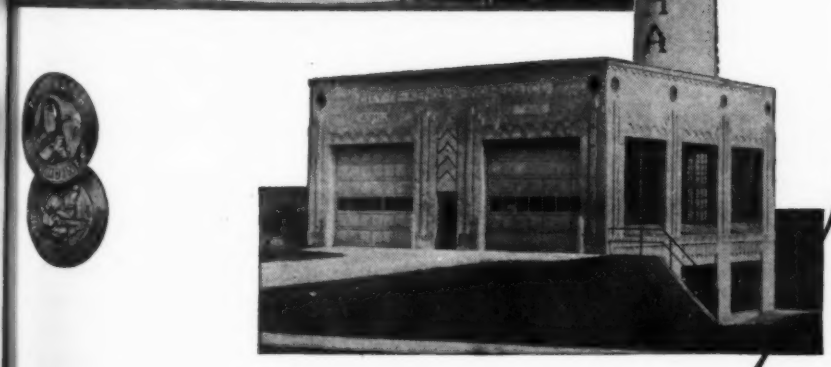


Do the job right!

WITH MODERN, EFFICIENT, HIGH TEMPERATURE

Incinerator Plants by PITTSBURGH-DES MOINES





Complete, odorless incineration of refuse is achieved by Pittsburgh-Des Moines *High-Temperature* Incinerator Plants, in types and capacities serving the needs of village or metropolis. Correct combustion principles and design flexibility adapt these units for the disposal of all mixtures of garbage and burnable rubbish peculiar to any locality, as well as combination refuse and sewage plant sludge incineration. Performance is guaranteed—consult with our engineers on your particular requirements!

PITTSBURGH · DES MOINES STEEL CO.

PITTSBURGH, PA., 3412 NEVILLE ISLAND—DES MOINES, IOWA, 913 TUTTLE STREET
NEW YORK, ROOM 915, 270 BROADWAY · CHICAGO, 1216 FIRST NATIONAL BANK BUILDING
DALLAS, 1217 PRAETORIAN BUILDING · SAN FRANCISCO, 619 RIALTO BUILDING
SEATTLE, 520 FIRST AVENUE, SOUTH

How much of this dream will come true?

IN RECENT years there has been a widespread awakening to the need for city planning.

From coast to coast, improvement projects are being proposed and adopted—a fact which reflects the true American spirit of progress.

But, although these proposed plans advance excellent ideas, they are often *too* ambitious, too costly, or otherwise impractical. In such cases, the plans must be drastically modified. Or they may be shelved forever.

In the field of sanitation, however, it will be possible for any city to make a great, yet entirely practical, advance. As an expert in that field, you would endorse no other kind of plan. For, in your work, you have had to be both visionary and realistic. Your important achievements of past and present, which have resulted in bringing under control such once-common diseases as typhoid, reveal this kind of thinking.

What is this next great advance in sanitation practice?

We believe that it will be *the combined transportation and disposal of sewage and properly processed food wastes*

via the existing sewer system and sewage treatment plant. By means of the General Electric Disposall*—an appliance which grates home food wastes into fine particles and flushes them down the kitchen sink drain into the sewer system—this advance will be realized *without affecting present sewage works practice!*

This method of removing food wastes—of eliminating the storage of garbage in the home—is in actual operation in many communities today.

QUESTIONS AND ANSWERS ABOUT THE DISPOSALL METHOD OF REMOVING GARBAGE

1. Why should garbage be eliminated this way?

Because garbage menaces public health, and should be disposed of *immediately.* It should *not* be left exposed in yards and streets where, as odorous, decaying organic matter, it attracts flies and rodents which spread disease.

You are familiar with the dangers of similar organic matter in the form of human wastes. Thus, you will realize that, like the outhouse of yesterday, the garbage can of today should be banished. The Disposall should and *can* replace the garbage can!

2. Has the Disposall been thoroughly tested?

Yes! More than ten years of testing in research laboratories, and in thousands of homes in several hundred communities, has proved that the Disposall is 100 per cent efficient in removing garbage, automatically.

3. Need you worry about sewer stoppages?

No. The Disposall grates food wastes into such fine particles that they flow freely through pipe lines, without shoaling or settling.

These wastes are finer, more water-buoyant and uniform than sewage solids now flowing through your lines. And they are ground in a controlled amount of cold water which congeals and homogenizes greases into a form which will not clog sewer lines.

4. Will your plant have to be expanded?

Not for many years will the number of Disposalls in your community become large enough to add appreciably to the loading on the treatment plant. Even if *every* home used a Disposall, the *volume* of sewage flow would be increased by less than two per cent.

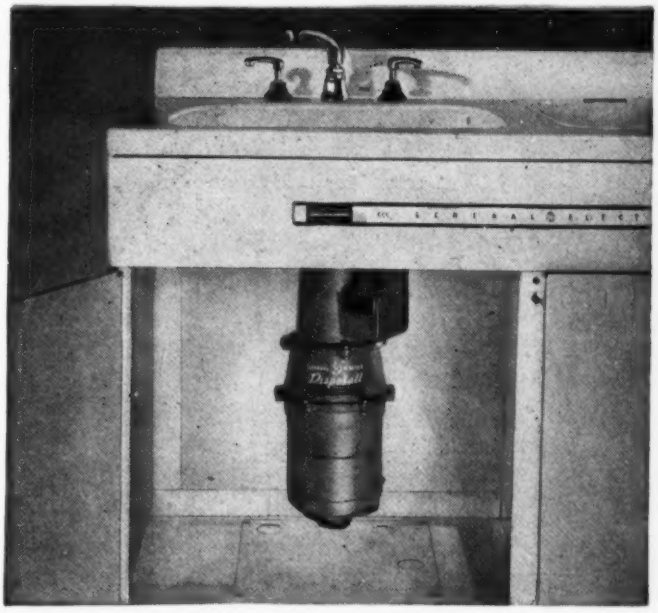
Naturally, the addition of food wastes to the sewage flow will increase the solids and organic loading on the plant. But many plants will be able to handle this increased loading indefinitely; others can be expanded when necessary.

5. Are sewage treatment plants necessary?

Whether or not Disposalls are used, we believe that every community should have a sewage treatment plant. The Disposall accentuates the need for these plants which provide a vital safeguard for public health.

6. Would you like to get more information?

If you want to learn more about the Disposall method of garbage disposal, we shall be pleased to send complete information. We shall be glad, too, to answer any specific questions you may want to ask. Write to Department WSW1046, Appliance and Merchandise Department, General Electric Co., Bridgeport 2, Conn.



The G-E Disposall shown installed in the G-E Electric Sink. Food wastes are scraped into drain opening and safety cover placed in position. Cold water tap is then turned on, starting the Disposall operation. Food wastes are grated and flushed away, automatically.

Disposall

*TRADE-MARK REG. U. S. PAT. OFF.

CONVERTS FOOD WASTE TO SEWAGE—ELIMINATES "GARBAGE"

GENERAL ELECTRIC

"SIMPLEX"

MEANS BEST IN SEWAGE PLANT EQUIPMENT

TYPE "MO" FLOW METERS

AIR DIFFERENTIAL FLOW METERS

AIR METERS

SEWAGE PUMP TAPS

PARABOLIC FLUME METERS

SEWAGE AIR RELEASE VALVES

RATIO CONTROL EQUIPMENT

MANOMETERS

SEWAGE AND SLUDGE PROPORTIONAL CONTROL EQUIPMENT

SUMMATION METERS AND GAUGES

TYPE "MS" FLOW METERS

SEWAGE TYPE VENTURI TUBES

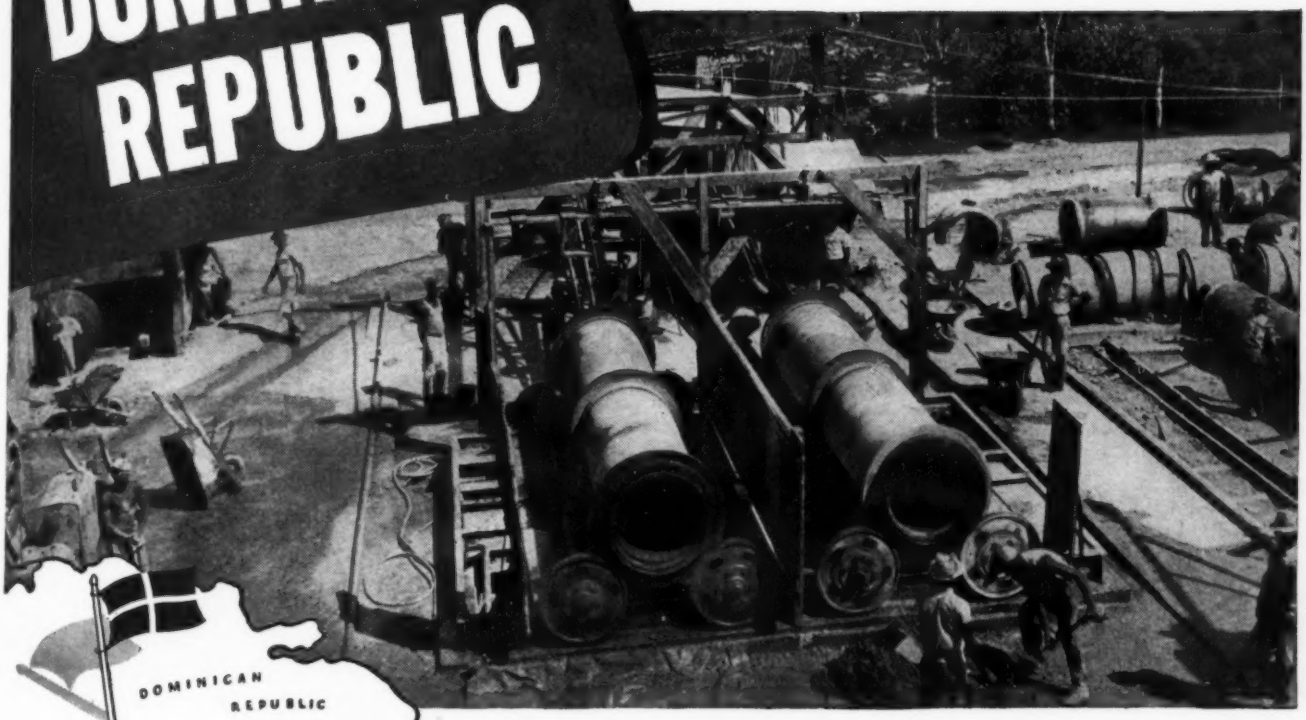
WRITE FOR FULL INFORMATION

SIMPLEX VALVE & METER CO.

6743 UPLAND STREET, PHILADELPHIA 42, PA.

The DOMINICAN REPUBLIC

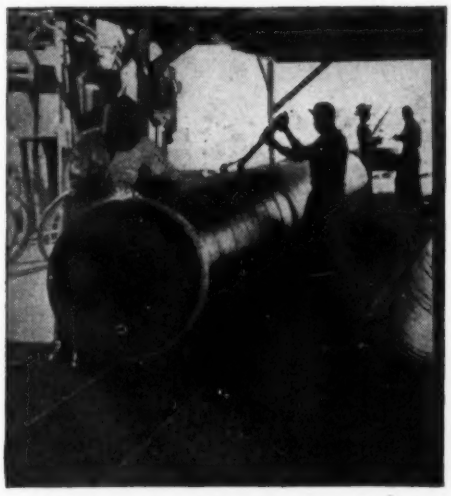
another important LOCK JOINT project



Now there is a greater water supply for Ciudad Trujillo . . . more comfort and better standards of living for the inhabitants of this fast growing Latin-American city.

It was a wise choice when the Dominican Republic specified Lock Joint Prestressed Concrete Cylinder Pipe . . . as the government was assured of the strongest pipelines under the sun – plus a sound return on the money invested. Under Lock Joint supervision there was a maximum use of local labor and native materials and every mile of the pipeline was "tailor-made" on the job in a manufacturing plant especially established at Ciudad Trujillo.

In addition, the Dominican Republic selected Lock Joint Prestressed Concrete Cylinder Pipe for this important project because of the many years of successful experience of the Lock Joint Pipe Company in the manufacture and installation of major water supply lines throughout the northern and southern hemispheres.



Welding JOINT RINGS *to the cylinder*

LOCK JOINT PIPE COMPANY

Established 1905

P. O. BOX 269, EAST ORANGE, NEW JERSEY

Denver, Colo. • Chicago, Ill. • Kenilworth, N. J. • Kansas City, Mo. • Rock Island, Ill.
Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. • Navarre, Ohio

SCOPE OF SERVICES Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

With the demand for pure water at a peak...

You

need the dependability of DIAMOND

Liquid **CHLORINE**

Because of the ever-increasing demand for water—and today's greater necessity for water treatment—the dependable high quality and uniformity of Diamond Liquid Chlorine are worth more than ever before! Our close control of all manufacturing processes guarantees the year-round high standard of our products.

DIAMOND ALKALI COMPANY

PITTSBURGH, PA. ***and Everywhere***

Jeffrey
SANITATION EQUIPMENT
for WATER, SEWAGE and INDUSTRIAL WASTES

Latest type of individual drives for SLUDGE COLLECTORS for primary tanks at Hammond, Indiana.

Individual view of one of the FLOCTROLS installed in Water Treatment Plant, Newark, Ohio. Shows arrangement of compartment and paddle wheels.

Factory-assembled, mechanically-cleaned BAR SCREEN. Screen is usually equipped with Grinder for disposal of screenings. Grinders available for all sizes of plants.

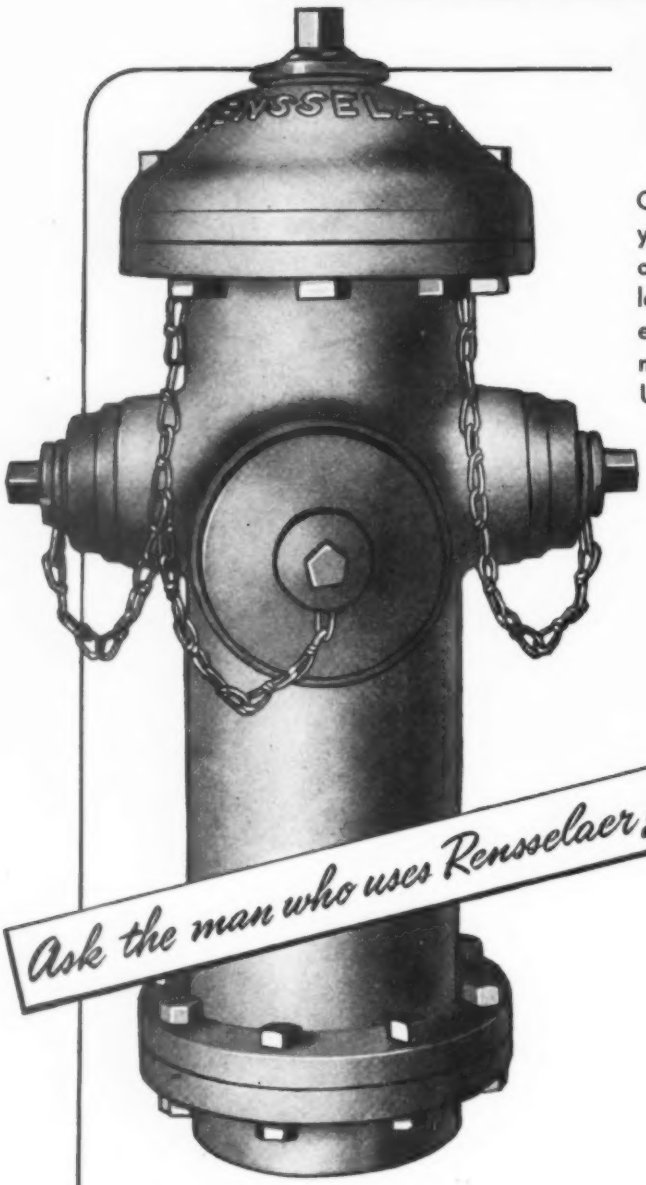
Bar Screens • Chemical Feeders • Grit and Sludge Collectors • Floctrols • Grit Washers • Dried Sludge and Screenings Grinders • Sterilization Plant Equipment.

JEFFREY

ESTABLISHED 1877

JM

RENSSELAER FIELD SERVICE



Ask the man who uses Rensselaer!

Our Representatives are Anxious to Serve You!

Our factory-trained representatives are at your service when and where you need them, on short notice. We back up known Rensselaer long-life with intelligent and timely Rensselaer engineering assistance. Warehouse stocks normally maintained at points throughout the U. S.

Defender FIRE HYDRANT

Backed by years of faithful service, Rensselaer Defender Fire Hydrants have proved their superiority in hundreds of installations. This superiority is based on constant research and application of engineering knowledge to actual field problems. As an example: Rensselaer Defender Hydrants are easier to service because all internal working parts can be removed by one man without special tools by simply removing hydrant head bolts. Many other features are described in our bulletin.

Write for Bulletin W

Please be patient. The wide acceptance of our products has made delivery dates uncertain.

PROMPT ATTENTION by the Rensselaer factory is assured whether you write, wire or phone a large order or a simple inquiry.

ATLANTA, GA.
17 Edgewood Ave., S.W.
BALA-CYNWYD, PA.
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CHICAGO, ILL.
53 West Jackson Blvd.
HAVERHILL, MASS.
Haverhill National Bank Bldg.
LOS ANGELES, CALIF.
Subway Terminal Bldg.
MEMPHIS, TENN.
519 Farnsworth Bldg.
NEW YORK, N. Y.
50 Church St.
OKLAHOMA CITY, OKLA.
817 Braniff Bldg.
PITTSBURGH, PA.
2203 Oliver Bldg.
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115 Townsend St.
SEATTLE, WASH.
1252 First Ave., South
WACO, TEXAS
206 Franklin Ave.

RENSSELAER VALVE CO.

TROY, N. Y.

Original Woodcut by Lynd Ward

More than 95% of the pipe in the water distribution systems of the 15 largest cities of the United States is cast iron pipe. And why not . . . when most of these cities have some or all of their original cast iron mains still in service? And, when records show that their cost of maintenance is far below that for other pipe materials? To these inherent advantages of long life and economy, U. S. Cast Iron Pipe adds *uniformity* of quality assured by rigid tests and controls, from raw materials to finished product.

U.S.
cast iron
PIPE

U. S. PIPE & FOUNDRY CO.
General Offices: Burlington, N. J.
Plants and Sales Offices throughout the U. S. A.

Badgers meet ALL REQUIREMENTS

There is a BADGER METER to meet your every requirement from a 5/8" household service to a 12" industrial installation.

MODEL A-IOT

The model A-IOT is of a frost proof design. Breakable bottom plates are attached to the main housing by heavy stud bolts. There is no possibility of corrosion or dirt causing the bolts to stick.

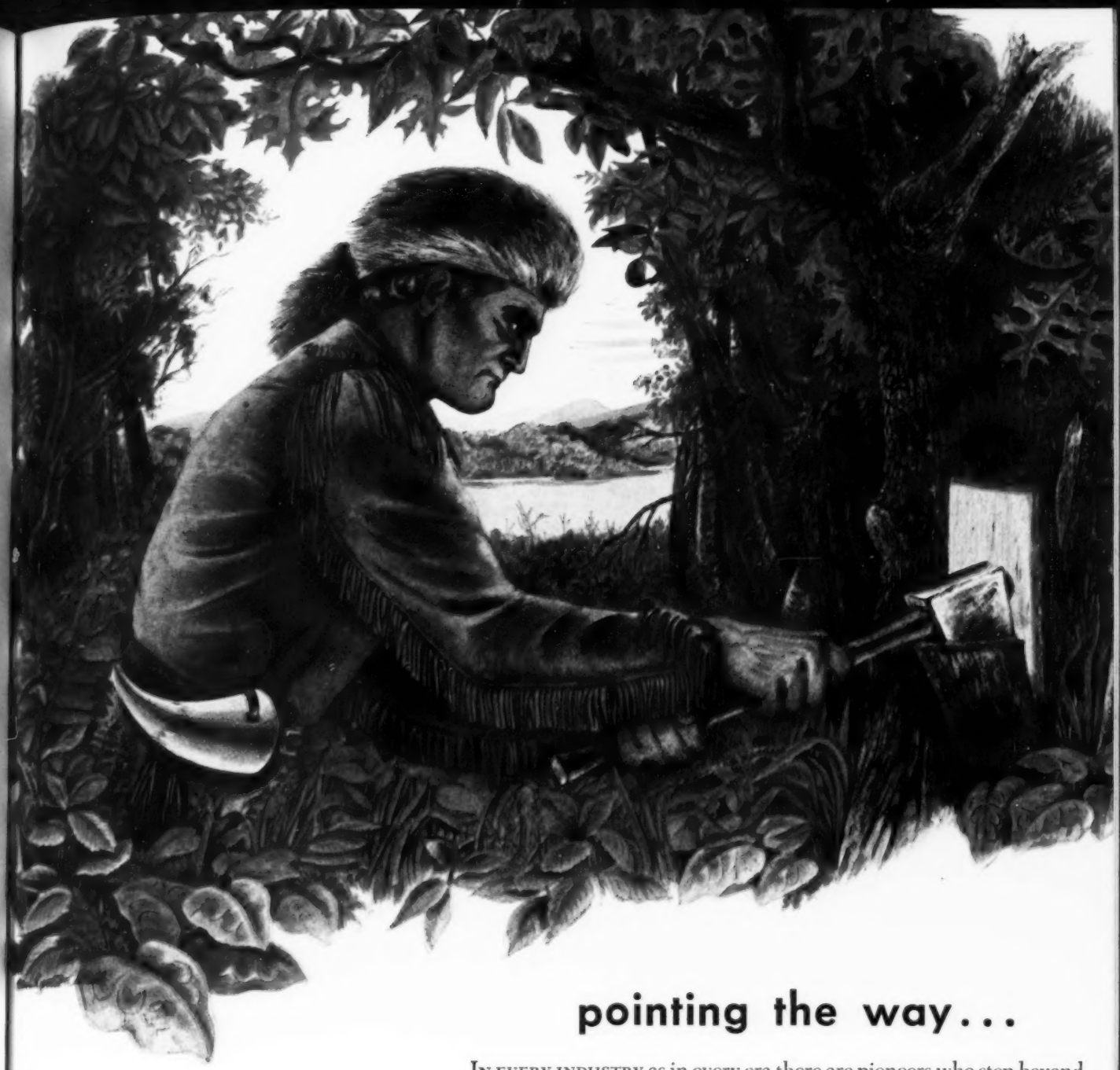
MODEL SC-IOT

The model SC-IOT is a split case meter for use in warmer climates, where there is no danger of freezing. Working parts can be removed from the housing without disconnecting meter from the line.

Both models have two-piece snap joint chambers, three piece discs and oil enclosed gear trains. Open gear trains are available without extra cost.

BADGER METER MFG. CO. · Milwaukee 10, Wisconsin, U. S. A.

Branch Offices: New York City - Chicago, Illinois - Waco, Texas - Portland, Ore. - Salt Lake City, Utah - Seattle, Wash. - Cincinnati, Ohio - Philadelphia, Pa. - Denver, Colo. - Worcester, Mass. - Kansas City, Mo. - Tampa, Fla. - Savannah, Ga. - Los Angeles, California



pointing the way...

IN EVERY INDUSTRY as in every era there are pioneers who step beyond the settled boundaries to "blaze" new trails toward new potentials in unexplored fields. In the field of electro-chemical development in America, Niagara Alkali Company has pioneered the way. First to produce caustic potash, carbonate of potash and liquid chlorine in this country and among the first to produce other chemicals of this type, Niagara has a long history of leadership behind its present service. This experience of Niagara consistently accrues to the benefit of users of Niagara products, providing dependably superior characteristics in product performance. This can become of immeasurable value to you in using such materials to improve the quality of your products or the efficiency of your manufacturing processes. Niagara Alkali Company, 60 East 42nd Street, New York 17, N. Y.

THE PIONEER CREED

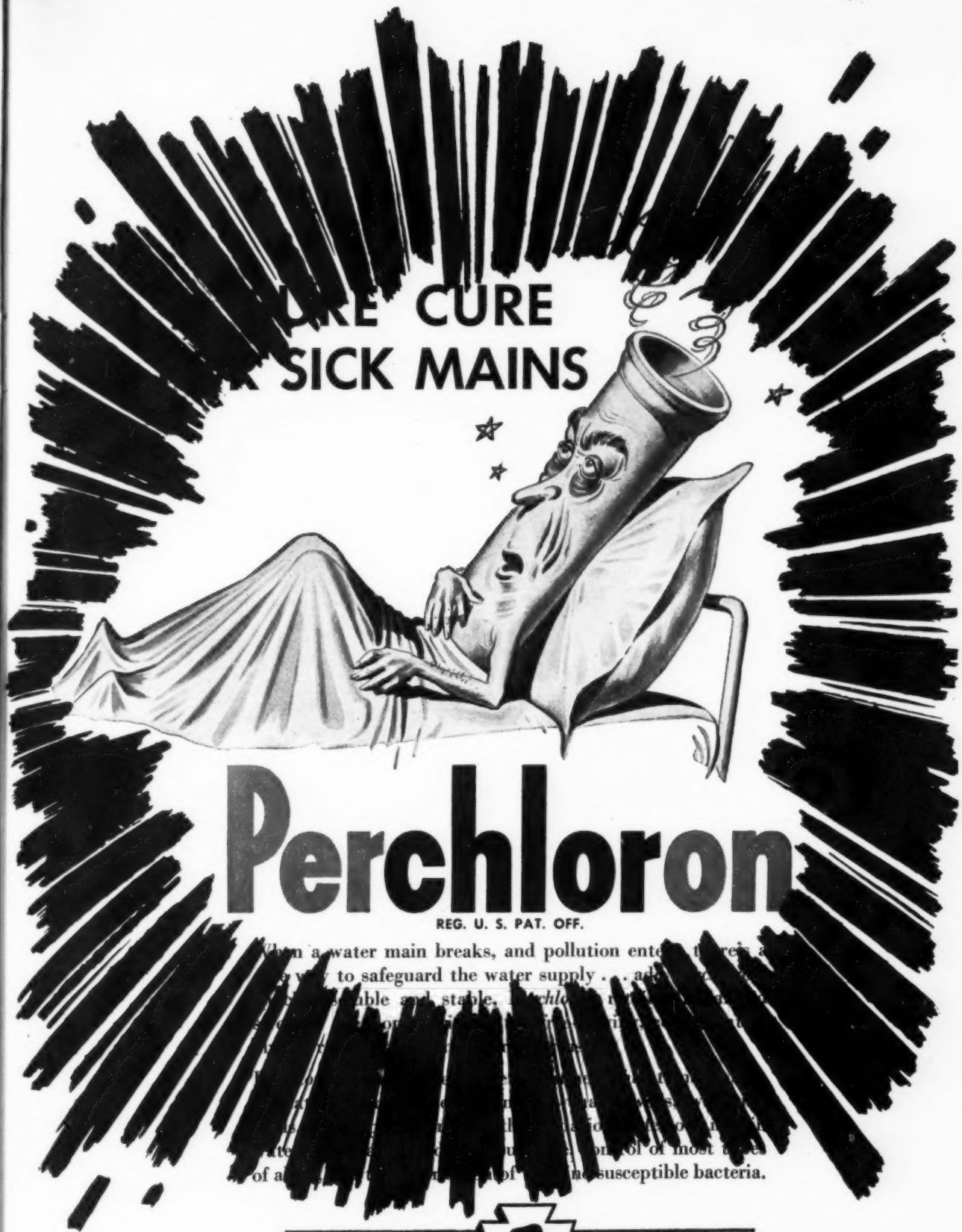
Always New, Always Better

Since the turn of the century Niagara has pioneered basic electro-chemical development in this country. This experience is reflected not only in Niagara product quality but also in the efficiency of the service Niagara extends to customers seeking to blaze new trails to product improvement.

AN ESSENTIAL PART OF AMERICA'S GREAT CHEMICAL ENTERPRISE

Niagara Alkali Company

CAUSTIC POTASH • CAUSTIC SODA
CARBONATE OF POTASH
LIQUID CHLORINE • NIAGATHAL
PARADICHLOROBENZENE



Perchloron

REG. U. S. PAT. OFF.

When a water main breaks, and pollution enters, there's a ... to safeguard the water supply . . . add... available and stable. Perchloron ... of most ... of ... susceptible bacteria.

PENN SALT

CHEMICALS

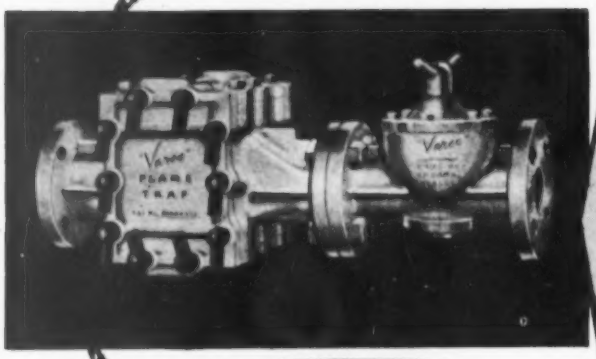
PENNSYLVANIA SALT MANUFACTURING COMPANY

1000 Widener Building, Philadelphia 7, Pa.

NEW YORK • CHICAGO • ST. LOUIS • PITTSBURGH • CINCINNATI • MINNEAPOLIS • WYANDOTTE • TACOMA

WHAT IS "Arresting Flame Propagation" IN THE DISPOSAL PLANT?

PACE SETTER



"Varec" Approved Flame Trap Assembly Figure No. 450

The "VAREC" Flame Trap Element is the same as used in our Figure No. 50A Flame Arrester which is:—

Listed by: UNDERWRITERS' LABORATORIES *for vent lines of oil tanks.*

Approved by: ASSOCIATED FACTORY MUTUALS LABORATORIES *for chemical and industrial plants.*

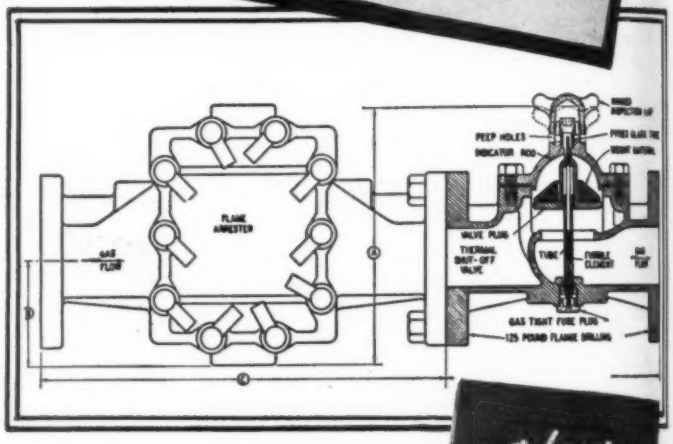
Approved by: U. S. TREASURY DEPARTMENT *for alcohol service.*

Approved by: U. S. DEPT. OF COMMERCE, LLOYD'S BUREAU OF SHIPPING, *and* THE AMERICAN BUREAU OF SHIPPING *for Tank Ship Service.*

In handling inflammable gases, the danger of fire and explosion is ever present. The impulse of fire to travel rapidly and to increase progressively along lines of least resistance produces "flame propogation". The arresting of this phenomenon is the duty of the "Varec" approved FLAME TRAP ASSEMBLY.

This unit consists of Flame Trap and Thermal operated Shutoff Valve. It is usually installed in all gas lines supplying gas utilization equipment, as close as possible to the points of combustion, and in lines leading from each digester and gas holder.

The Unt is fully self-contained, simple and fool-proof —a positive flame trap. The fusible element melts at 200°F. and stops gas flow within 15 seconds. New compression type fusible element is so designed that shutoff valve positively cannot close unless contacted by flame.



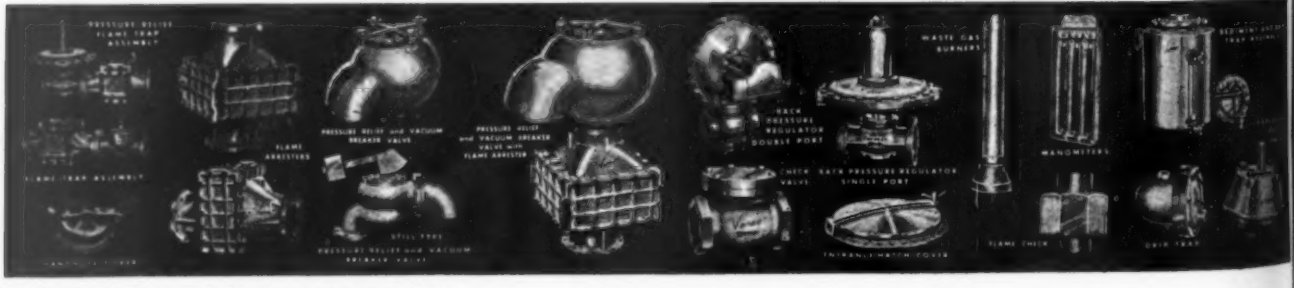
"Varec" Engineering and Laboratory Services will collaborate with you on all phases of "arrecting Flame Propagation."

"Varec" Catalog S-3 contains all "Varec" Equipment necessary in the operation of the disposal plant safely and efficiently. It's yours for the asking.

THE VAPOR RECOVERY SYSTEMS COMPANY

COMPTON, CALIFORNIA, U.S.A.

NEW YORK CITY—CHICAGO, ILL.—HOUSTON, TEX.—TULSA, OKLA.
Agencies everywhere—Cable Address VAREC COMPTON (All Codes)



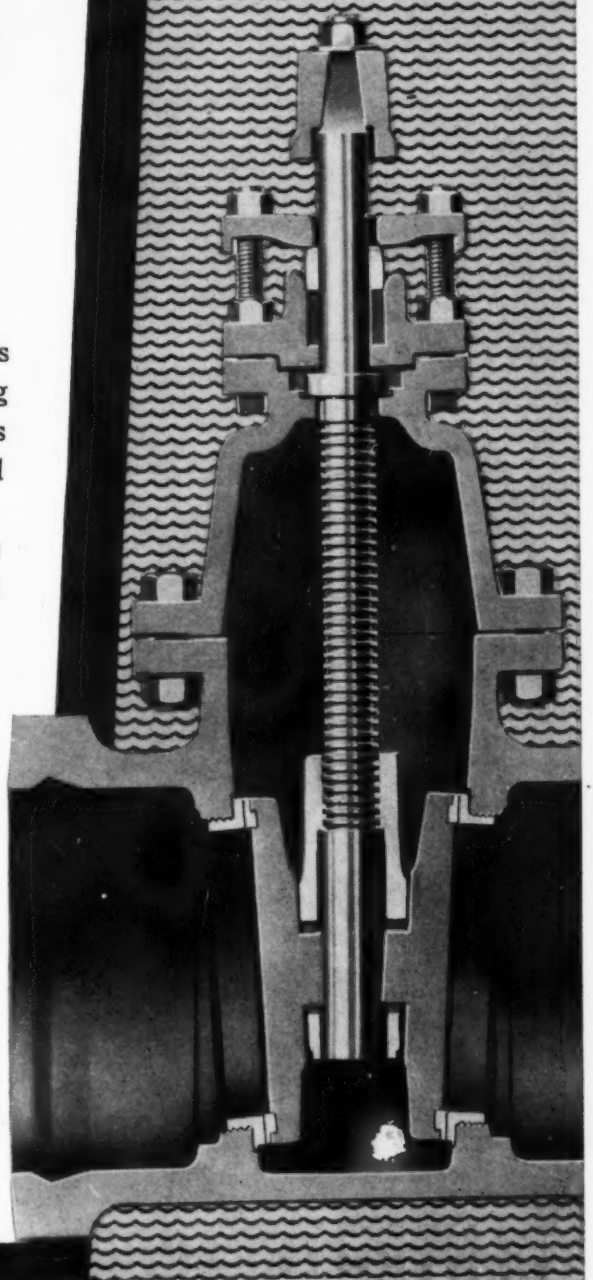
BURIED TROUBLE IS *DOUBLE* TROUBLE!

When a faucet in the sink fails to operate, it's a small matter to fix it. But when something goes wrong with a buried gate valve, it costs considerable time, money, man-power and materials to repair the trouble.

That's why R. D. Wood Gate Valves are designed to be the ultimate in simplicity and dependability. There are only three internal parts, besides the stem. Rotating on their trunnions, the two discs *distribute* the wear, making it negligible. The spreader (the No. 3 member) thrusts from the center in closing, and the discs seat without distortion. Flow is full capacity. There are no pockets to collect sediment.

R. D. Wood Gate Valves are made to fit standard type joints. They meet requirements of the AWWA. They have an enviable record for long and trouble-free service.

• In the public interest, R. D. Wood recommends that all gate valves be checked twice a year.



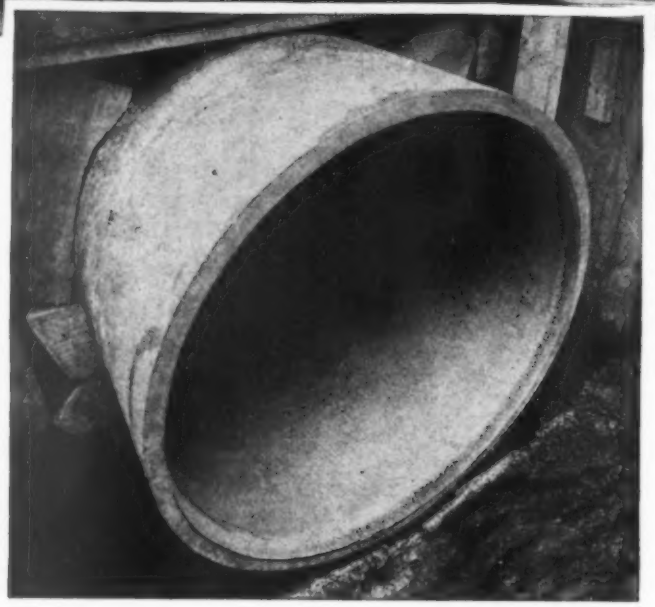
R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING
INDEPENDENCE SQUARE, PHILADELPHIA 5, PA.

Established in 1803

MANUFACTURERS OF MATHEWS HYDRANTS AND SANDSPUN PIPE
(CENTRIFUGALLY CAST IN SAND-MOLDS)

CENTRILINE GOES TO WASHINGTON ...for the third time!



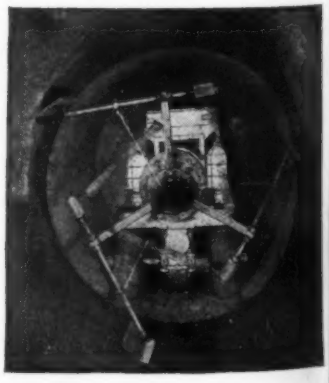
ONCE again Centriline was elected to service the nation's capital—and do another important reconditioning job for the Water Department of the District of Columbia. Nearly 30,000 feet of cast-iron pipe, varying in sizes from 30″ to 48″, were cleaned and cement lined—speedily and economically. This sleek new lining will provide a non-corrosive, non-tuberculating surface to shield the underlying metal—assuring a permanently high coefficient and increased longevity.

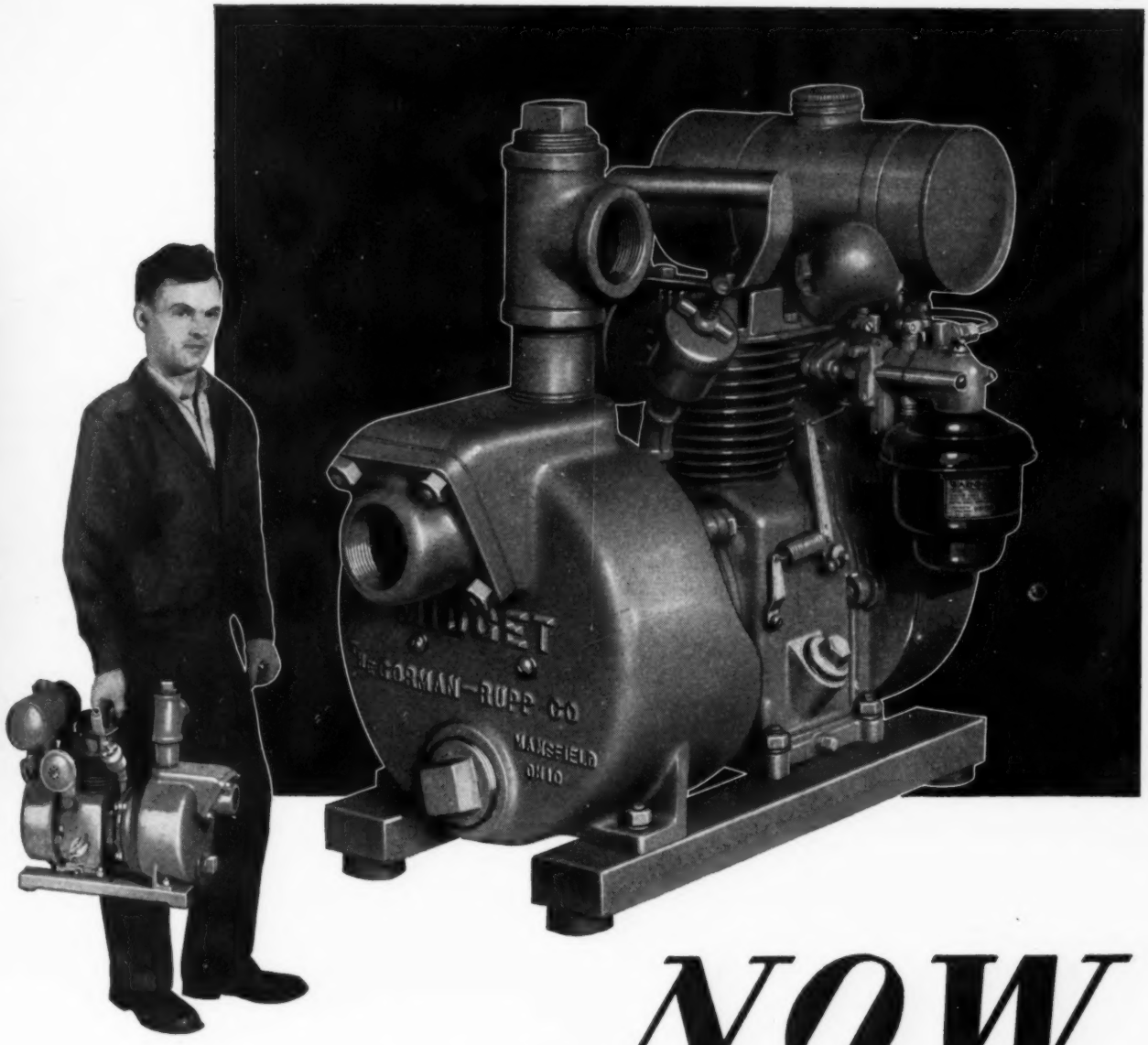
CENTRILINE CORPORATION

148 CEDAR STREET • NEW YORK 6, N. Y.

Restores and Protects Pipe-Line Carrying Capacity

The Centriline process is a rapid, economical method of reconditioning pipe lines 30″ and larger. After cleaning, a thoroughly premixed cement mortar lining of desired thickness is applied centrifugally without rebound. This dense quality product is mechanically trowelled to a smooth finish providing maximum carrying capacity which is permanently sustained. This work is performed underground, in place.





. . . NOW

You can have a pump with your tool kit!

The Gorman-Rupp "Midget" is a lot of pump in a very small package. Although it weighs only 60 pounds, it will pump 3000 gallons per hour against a 20 ft. head and will do it for months at a time without attention. The Midget is the smallest of four Gorman-Rupp lightweight pumps. These handy pumps can handle many small drainage jobs and can be quickly and easily transported. They are the toughest little pumps you ever saw and are simple to operate—no valves—fully automatic, self-priming. They are non-clogging—any muck or solids that will pass the intake strainer will clear through the pump.

Other Gorman-Rupp centrifugal pumps are made in sizes ranging up to 125,000 gallons per hour capacity.

Try a Gorman-Rupp on your next job. If it does not do a better job than any pump you ever saw, you can return it at our expense. Write for further information or contact your distributors.

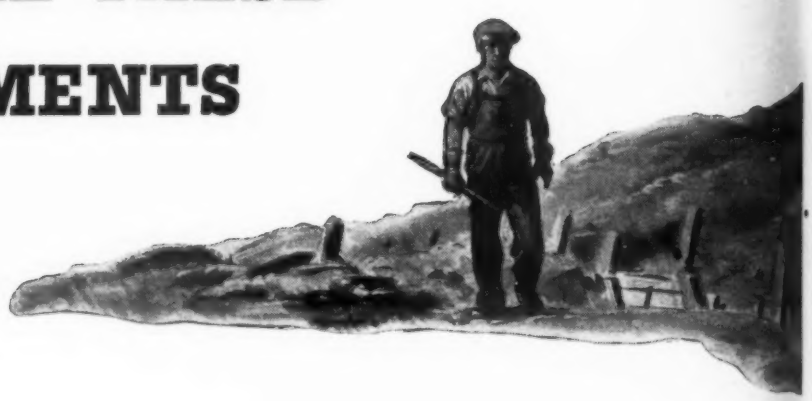
For Details call your nearest distributor.

THE GORMAN-RUPP COMPANY

Gorman-Rupp Pumps — Unsurpassed for Pumping Part

327 Bowman Street — **Mansfield, Ohio**

No OTHER PIPE MATERIAL MEETS ALL THESE REQUIREMENTS



The one and only pressure pipe material that has proved its ability to meet all these requirements: service under ground for all pressures (any soil* or depth of fill)—service under water (salt or fresh)—service above ground (over a salt marsh, for instance)—service in a plant (water purification or sewage treatment)—is *good gray iron* of which cast iron pipe is made.

Because of its all-purpose adaptability, our members furnish cast iron pipe with joints for every service requirement, as shown on the page opposite.

What other pipe material offers you a comparable combination of long life, beam strength and impact strength, high resistance to internal and external pressure? Echo answers—none!

Cast iron pipe offers you, among other advantages—

(1) *A Century or more of useful life as a structure.* (The *proved* useful life of cast iron pipe is more than double the *estimated* life of other pressure pipe materials, under normal conditions.)

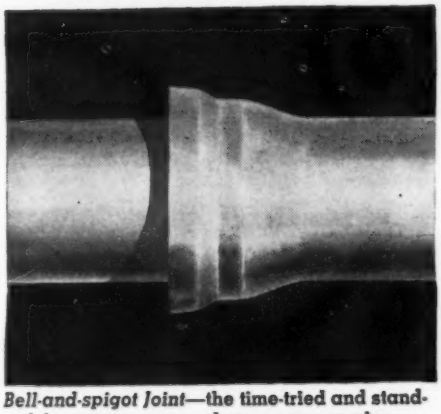
(2) *A Century or more of high capacity as a carrier.* (In locations where tuberculating waters are encountered, cement-lined cast iron pipe assures high carrying capacity for the life of the pipe.)

Does any other pressure pipe material offer you all the advantages of cast iron? Echo answers—no! Cast Iron Pipe Research Association, T. F. Wolfe, Research Engineer, Peoples Gas Bldg., Chicago 3.

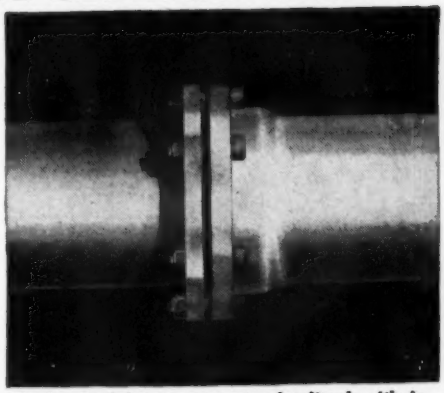
**For "super-hot" soils cast iron pipe is furnished with protective coatings.*

CAST IRON PIPE

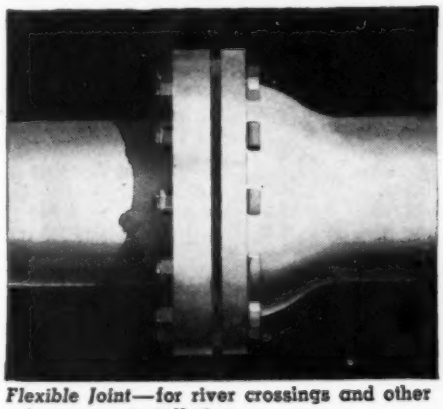
A JOINT FOR EVERY SERVICE NEED



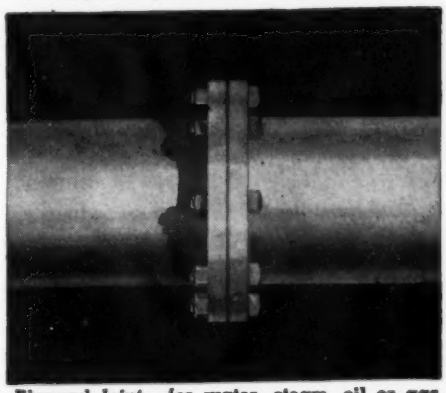
Bell-and-spigot Joint—the time-tried and standard for water, gas and sewerage service.



Mechanical Joint—now standardized with interchangeable parts—for all pressures.



Flexible Joint—for river crossings and other sub-aqueous installations.



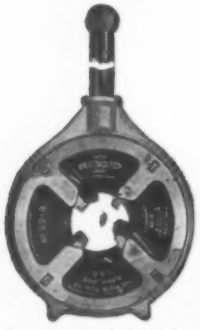
Flanged Joint—for water, steam, oil or gas lines generally used above ground.

Other joints are available for special purposes

Serves for Centuries

You save time and work when you thread pipe with this RIDGID No. 65R

Tighten on pipe with 1 screw



It stands up handily on its own feet.

● Threading 1" to 2" pipe is no chore at all with the self-contained quickly adjusted No. 65R threader. Its high-speed steel chasers set to size in 10 seconds — no loose dies to bother with or lose. Workholder sets to pipe size instantly — no bushings, only one screw to tighten on pipe. And you cut smooth perfect threads with the least possible effort. See for yourself why it's so popular — ask for this time and work-saver No. 65R threader at your Supply House.

Only RIDGID guarantees you a repair-free housing . . .

UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free
THE RIDGE TOOL CO.
ELYRIA, O.

SIZES 6" TO 60"

RIDGID *Compound Leverage Wrench.*

● You get more for your money with RIDGID pipe wrenches. That special design housing simply won't warp or break in any normal use, however strenuous — as millions of users know. No laid up for housing repairs, no bother and expense. No binding of adjusting nut — it spins easily to size. Alloy jaws take hold and let go instantly. Handy pipe scale on hookjaw, comfort-grip I-beam handle. A wrench it's a pleasure to work with — ask your Supply House.

Millions of RIDGID Tools in use

★ RIDGID ★

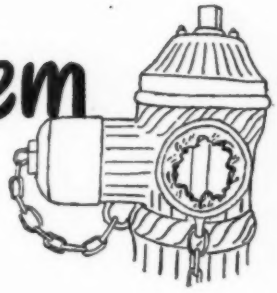
WORK-SAVER PIPE TOOLS

The Ridge Tool Company
Elyria, Ohio, U. S. A.

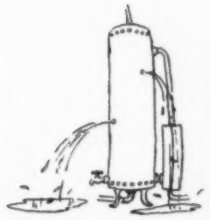
The Place

Etobicoke Township, Ontario, Canada

The Problem



CORROSION IN MAINS... *resulting in many complaints* of **"RED WATER"** and **RAPID DESTRUCTION OF HOT WATER TANKS** *by corrosion.*



The Solution... *THRESHOLD TREATMENT WITH* Calgon*

The manufacturers of Calgon claim-
ed that if properly used it would pre-
vent red water, would break down
lime and iron deposits in the distribu-
tion system and plumbing and heating
equipment, and would further protect
these metals from corrosive action.
These claims in so far as Etobicoke is
concerned, appear to have been fully
justified.

What has been very noticeable
is the fact that complaints have ceased
to come in regarding the clogging of
heating coils, etc., or the destruction
of hot-water tanks. Red water has
ceased to be a problem, and only occa-
sionally is hydrant flushing required.

THE WHOLE STORY is told by Franklin McArthur, Township Engineer, under the title "Water Treatment in Etobicoke," in the April issue of *Water and Sewage*. We will be glad to send you a reprint of the complete article.

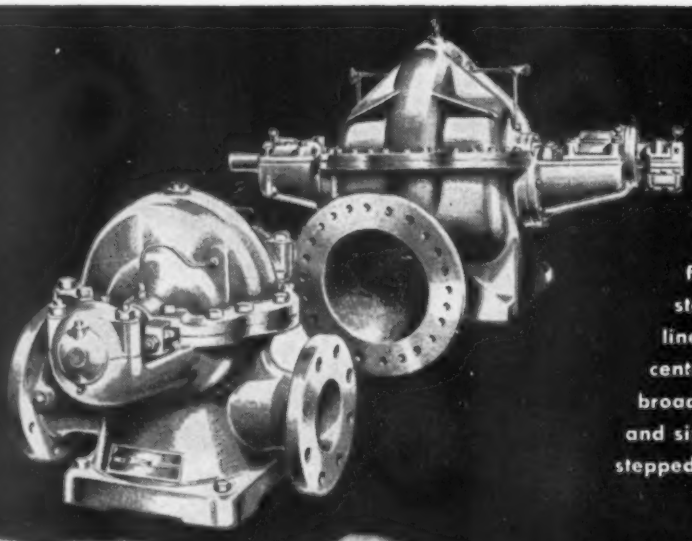
**T. M. Reg. U.S. Pat. Off.*

HAGAN HALL BUROMIN CALGON

calgon, inc.

A SUBSIDIARY OF HAGAN CORPORATION

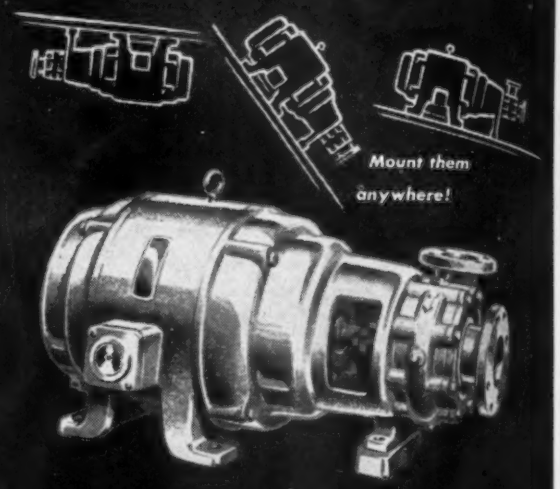
HAGAN BUILDING PITTSBURGH 30, PA.



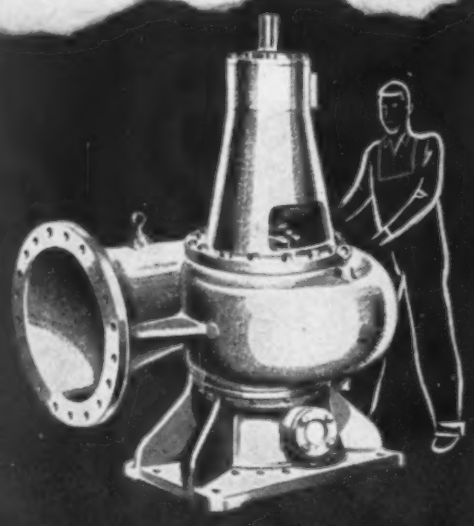
The older they are the farther they fall in attempting to meet standards that are being set by the line of Fairbanks-Morse split-case centrifugal pumps. Here's a line that's broad enough to include the type and size which most closely meets your stepped-up needs.

Time to Forget . . . and Remember!

Now is the time to forget your old pumps whose efficiency is that of a bygone era and whose daily services are costing you money! Remember—pumps are commonly designed and built to answer specific conditions of head and capacity: When these conditions change, the increase in pumping costs may be appreciable.



Replace tired-out, hard-to-get-at pumps with Fairbanks-Morse Builtogether pumps—packaged units, with pump and motor on a single shaft. Used industry-wide, they move up to 1200 gallons per minute at heads up to 260 feet.



Name your pumping job— there's a modern Fairbanks-Morse "high-efficiency" pump ready to handle it. For instance, the line of vertical Angle-Flow pumps for moving lots of water—up to 80,000 g.p.m.—at a cost that, even compared with modern standards, is extremely low.

Three famous names— Fairbanks-Morse, Pomona and Westco are gilt-edged evidence that when you see your Fairbanks-Morse dealer or call at your Fairbanks-Morse branch office, you're taking the right step toward lowest liquid-moving costs.

FAIRBANKS-MORSE

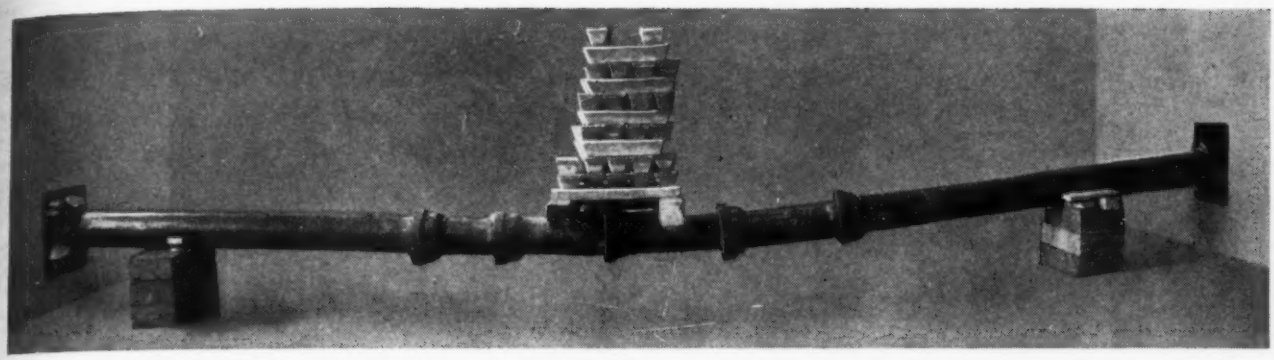
A name worth remembering

DIESEL LOCOMOTIVES · DIESEL ENGINES · MAGNETOS · GENERATORS · MOTORS · PUMPS
SCALES · STOKERS · RAILROAD MOTOR CARS and STANDPIPES · FARM EQUIPMENT

QUESTION FOR EVERY WATER WORKS ENGINEER

HOW MUCH STRAIN

should your Pipe Joints be able to stand...?



This picture of Tegul-MINERALEAD line was taken when load reached 2885 lbs., the lead line having failed at 2000 lbs.

Bell & Spigot Line installations must from time to time, meet unpredictable conditions — settling of supporting terrain, for example.

To see what might happen under such conditions, a committee of city engineers considering the use of *Tegul*-MINERALEAD made the test you see above. For purposes of comparison this included parallel lines, identical, except that one was joined with *Tegul*-MINERALEAD, the other with lead. Each was supported only at either end.

Under a load of 2000 lbs. of pig lead, the lead line sank to the floor. The *Tegul*-MINERALEAD line went down at *5760* lbs. — nearly three times the weight that collapsed the lead-jointed line. Throughout the test water pressure in the line was maintained at far above the 300 lb. limit registered by the gauge at the left — *and* the *Tegul*-MINERALEAD *line developed no leaks.*

This test goes probably far beyond anything *your* water lines will ever have to withstand, but the same good jointing material that came through this with colors flying, will serve you well under any conditions it may have to meet.

To save time, labor and trouble in laying and maintaining Bell & Spigot water lines, acquaint yourself with the advantages (unmatched in total in any other compound for its purpose) that are yours in

Tegul-MINERALEAD

- 10 lb. ingots, easy to handle, ship and store.
- Impervious to moisture, may be stored in the open.
- Cannot change its correct physical composition.
- Thiokol base reduces initial leakage to minimum. Back filling can be started at once.
- Skilled labor, deep bell holes and caulking are not required.

You can reach an ATLAS representative at the nearest listed branch office. For illustrated literature, address our Mertztown Office.

We also manufacture GK and AMPCO Sewer Jointing Compounds

THE *Atlas Mineral*

PRODUCTS COMPANY OF PENNA.

MERTZTOWN PENNSYLVANIA

*ATLANTA 3, Ga., 452 Spring St., N. W.

*ATLANTA 3, Ga., 452 Spring St., N. W.
*CHICAGO 1, Ill., 333 No. Michigan Ave.
*DETROIT 2, Mich., 2970 W. Grand Blvd.
NEW YORK 16, N. Y., 280 Madison Ave.
PITTSBURGH 10, Pa., 4656 Old Boston Rd.
ST. LOUIS 8, Mo., 4485 Olive St.

THE ATLAS MINERAL PRODUCTS CO. OF TEXAS, INC. Box 252, Houston 1, Texas

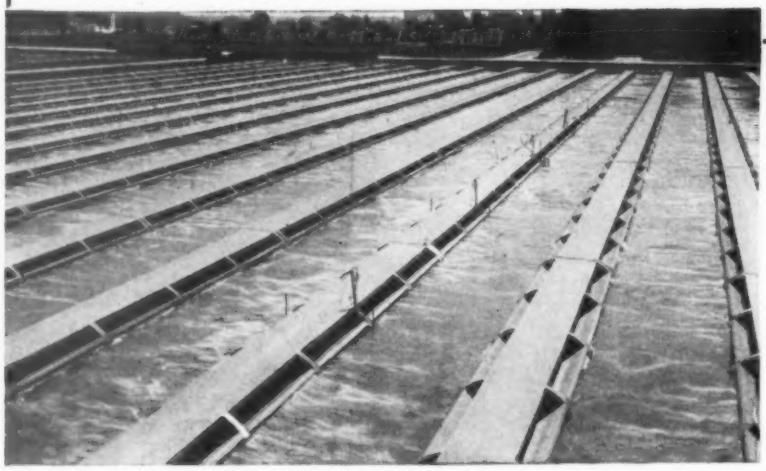
*DALLAS 5, Tex., 3921 Purdue St.
*DENVER 2, Colo., 1921 Blake St.
*KANSAS CITY 2, Kan., 1913 Tauromee Ave.
*LOS ANGELES 12, Cal., 172 S. Central Ave.
*HONOLULU 2, Hawaii, U.S.A., Lewers & Cooke, Ltd., P. O. Box 2930
*SALT LAKE CITY 11, Utah, 1212 S. State St.
SAN FRANCISCO 7, Calif. H. G. Roberts, 115 Townsend St.
*SEATTLE 4, Wash., E. N. Hallgren Co. 1252 First Avenue, S.

IN CANADA: H. L. BLACHFORD, Limited, 977 Aqueduct Street, Montreal, P. Q.

*Stock carried at these points

Performance in World's Largest Sewage Treatment Plant...

...leads to extended use of Everdur Electrical Conduit



Everdur Electrical Conduit serves the aeration and final settling tanks in bringing power from the operating galleries to the sluice gates at the control centers, and from these centers to the operating mechanism on the center pier of each tank.

General view of Southwest Sewage Treatment Works, Chicago, world's largest sewage plant.

Electrical tunnel, showing Everdur Electrical Conduit in course of installation. In all, 14 miles of such conduit were required.

WHEN Chicago's Southwest Sewage Treatment Plant was built ten years ago, a total of 14 miles of Everdur* Electrical Conduit, in sizes from ¾" to 2½", was installed . . . about 80,000 lb. of conduit and 20,000 lb. of fittings and boxes.

Conduit of Everdur Metal was selected because of its high physical properties and excellent resistance to many corroding agents. Today this Everdur Conduit is still giving excellent service where rustable conduit has failed. Additional Everdur Conduit has been ordered for early installation.

For detailed information on Everdur Copper-Silicon Alloys in Sewage and Water Works service, write for Publications E-11 and E-6.

*Reg. U. S. Pat. Off.

ANACONDA

Everdur

COPPER-SILICON ALLOYS

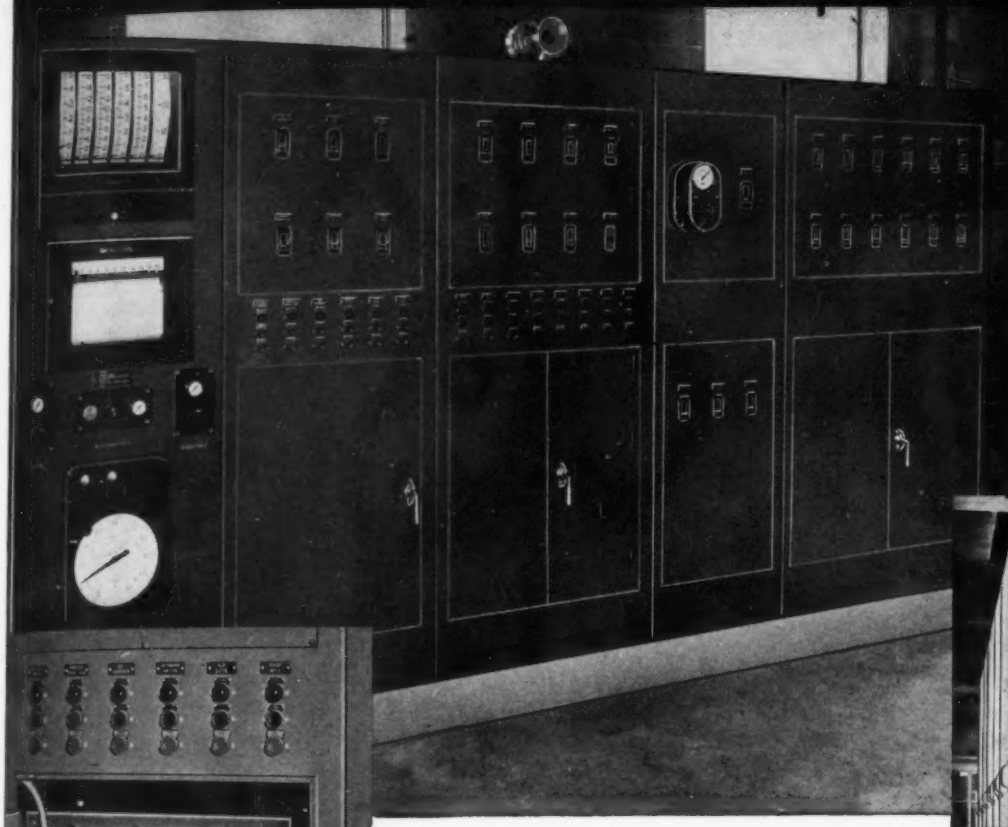
THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

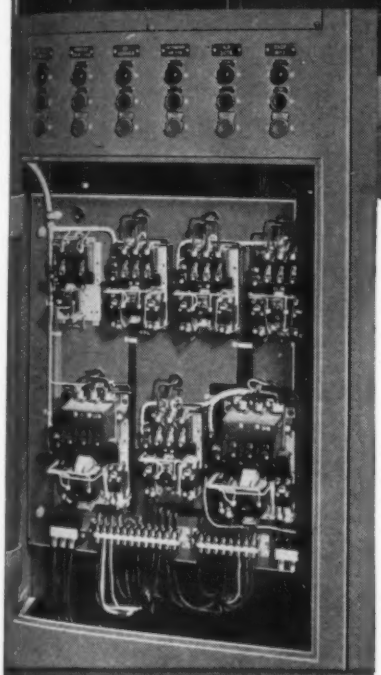
Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

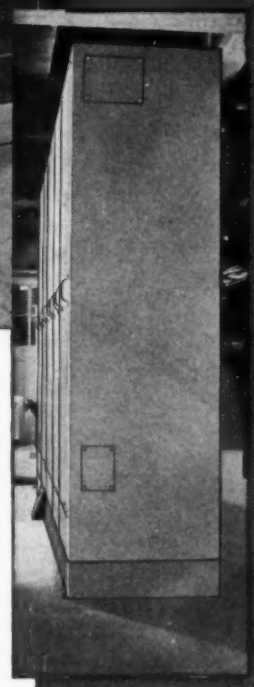
Neat, Compact, Efficient - "3C" CUBICLE CONTROL CENTER for 21 Motors at SEWAGE TREATMENT PLANT



Cubicle at extreme left contains instrument panel; next two, the "3C" electrical control for pulverizing equipment; the fourth, Incoming Power and Lighting Panel; fifth, control for filter equipment. 21 motors are controlled by "3C" apparatus in these cubicles.



Open view of second cubicle—containing motor controls for pulverizing machinery. Note how neatly and compactly the "3C" control apparatus is installed, and how accessible for inspection through wide opening door.



End and rear view of cubicles, showing removable back plates, for easy access to wiring, and panel openings at end, which, with identical location on both sides of each cubicle, permit passage of continuous bus bar and control wires.

● Standardization of dimensions makes it possible to assemble any number of Clark Control Cubicles in a neat, symmetrical, "dead-front" Cubicle Control Center—with provisions for adding identical Cubicles later. The control center illustrated was installed recently at a Wisconsin sewage treatment plant which dries the sludge and pulverizes it for sale as fertilizer. "3C" controls help this plant realize considerable revenue from this source.

Our District Offices or Agencies will gladly work with you on your electrical control problems. Write for fully descriptive "3C" Bulletin 9900.

THE CLARK CONTROLLER CO.

1146 EAST 152nd ST., CLEVELAND 10, OHIO • EVERYTHING UNDER CONTROL

Regular Split Case
Disc Type Model,
5/8" to 1"

Now as always

...AMERICA'S FIRST WATER METER

The first water meter patented in the U. S. was a Worthington, in 1855. And after nearly a century of continued development, its direct descendants — Worthington-Gamon "Watch Dog" Meters—still lead in efficient, economical meter performance.

Made of the finest materials, as technically perfect as the most complete research and production facilities can make them, "Watch Dog" Water Meters are today standing guard over the water supplies of thousand of communities with accuracy, durability and low-cost maintenance . . . Before you specify, be sure to investigate the many advantages of Worthington-Gamon "Watch Dog" Meters.

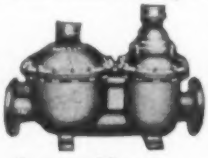
55-7

"WATCH DOG" WATER METERS

"Watch Dog" Models . . . made in standard capacities from 20 gpm up; frost-proof and split case models in standard household sizes. All meters, Disc type, Turbine type and Compound type, comply with specifications of cold-water meters adopted by American Water Works Association . . . Write for Bulletin.

Made by America's First Meter Manufacturer—
Today's First Choice in Thousands of Municipalities

Disc Type:
1½" to 6"



Compound Type:
2" to 8"

IH Turbine Type:
2" to 8"

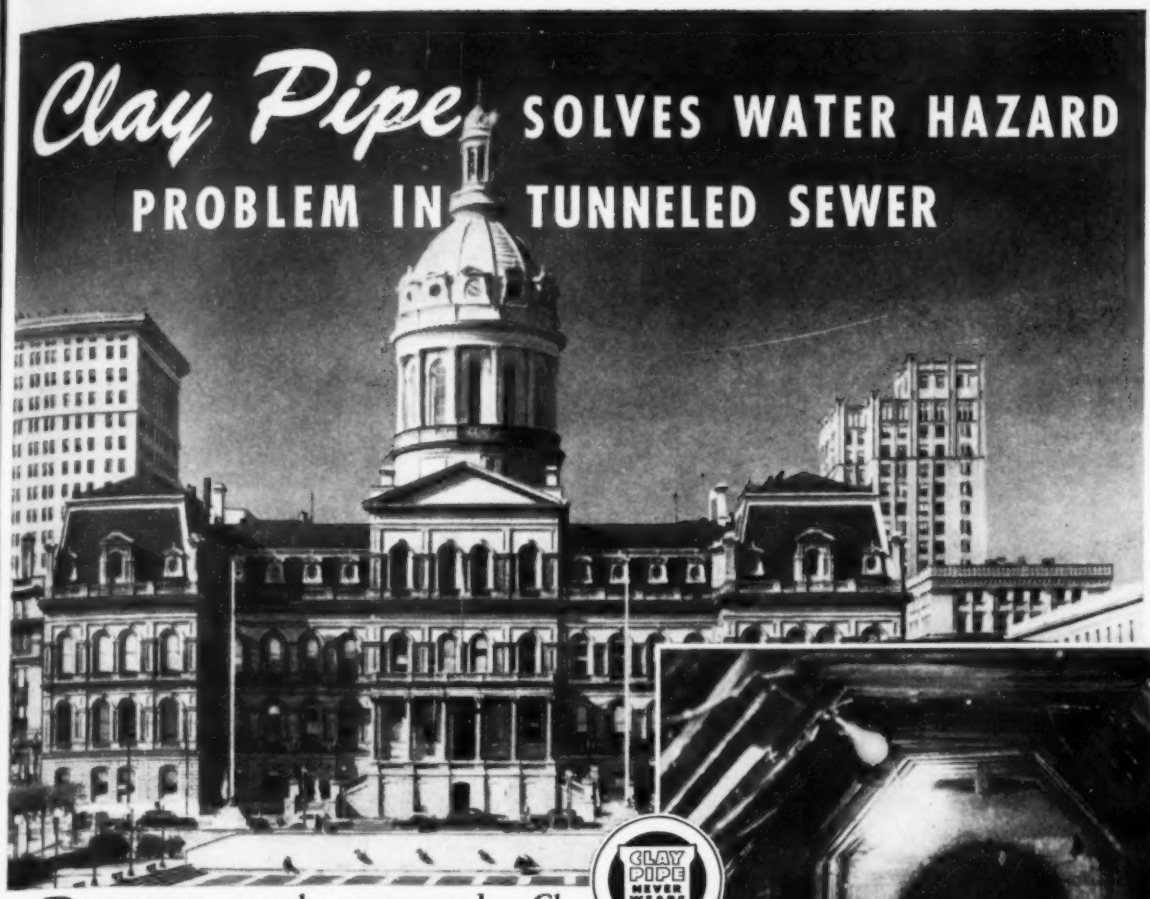
WORTHINGTON-GAMON METER COMPANY

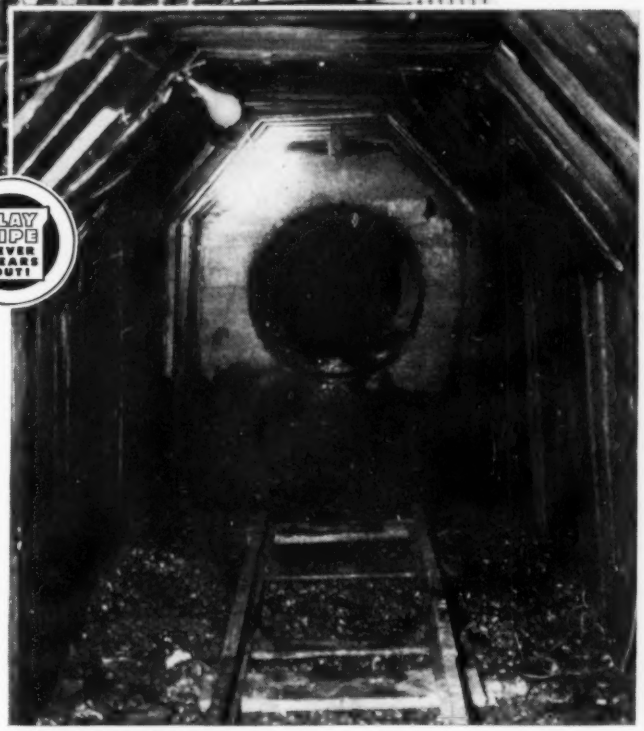
296 South Street, Newark 5, New Jersey

Subsidiary of

WORTHINGTON
PUMP AND MACHINERY CORPORATION

Clay Pipe SOLVES WATER HAZARD PROBLEM IN TUNNELED SEWER



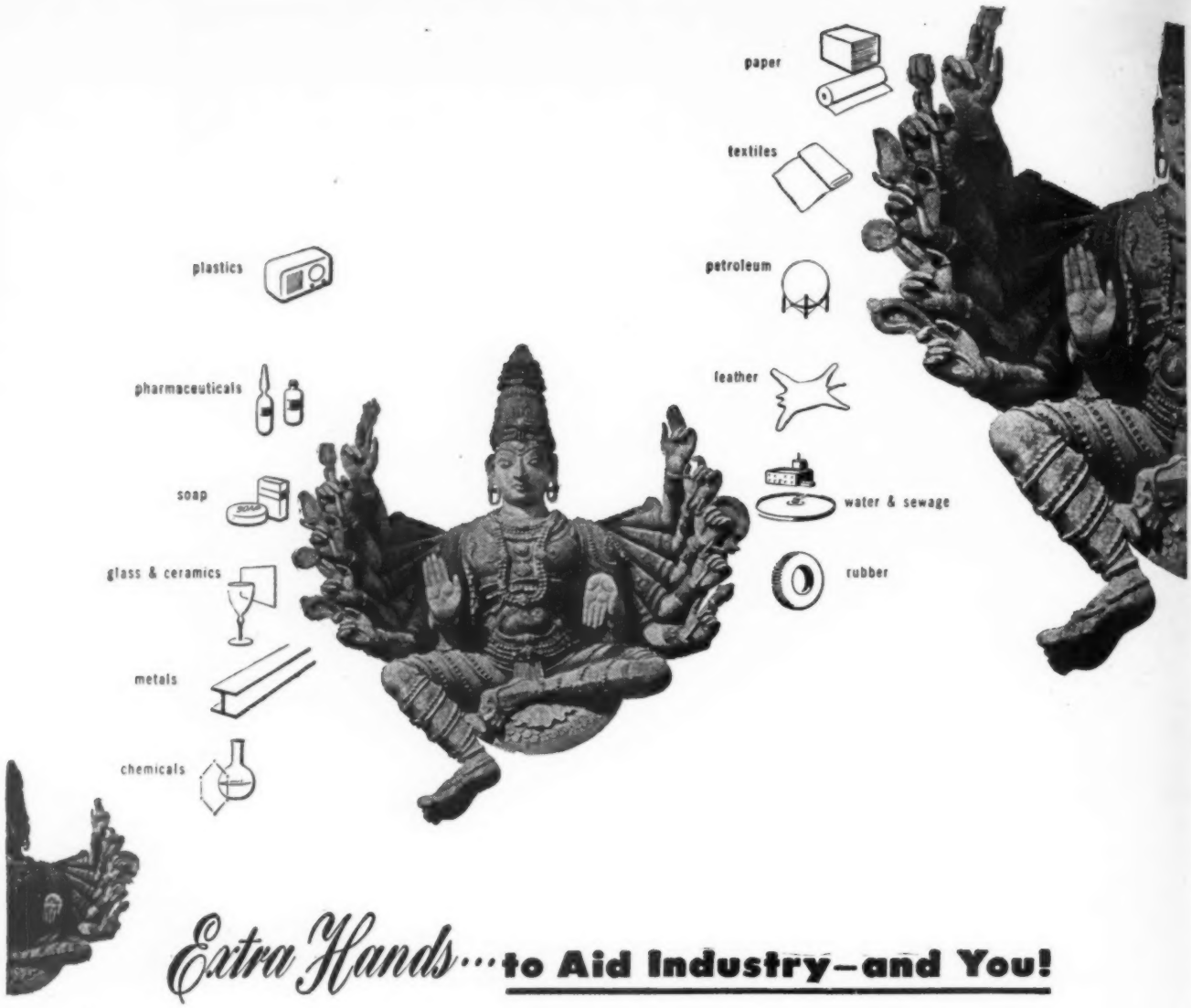


BALTIMORE recently constructed a Clay Pipe sewer in a tunnel from 33 to 55 feet below ground surface, and from 10 to 16 feet below tide level in a nearby stream . . . the sewer being below water level at all points. To meet the rigid requirements of this project and to provide a sewer line impervious to corrosion, crumbling and rust, Clay Pipe was specified. Twenty-seven-inch Extra-Strength Clay Pipe was used for 2100 feet, and the remainder of the line was monolithic concrete protected by Vitrified Clay Liner Plates.

On any project where sewage or drainage lines must withstand extraordinary conditions . . . take the bruising punishment of heavy traffic . . . it PAYS to use Clay Pipe! For information about Clay Pipe, write to nearest office listed below:

NATIONAL CLAY PIPE MANUFACTURERS, INC.
111 W. Washington St., Chicago 2, Ill.
522 First National Bank Bldg., Atlanta 3, Ga.
1105 Huntington Bank Bldg., Columbus 15, Ohio
571 Chamber of Commerce Bldg., Los Angeles 15, Calif.

TUNNELING . . . rather than open-cut excavation . . . was employed in installing this Baltimore sewer line built of Clay Pipe and Clay Liner Plates. The project was carried out by the Baltimore Bureau of Sewers, Nathan L. Smith, Chief Engineer; George E. Finck, Head of Bureau; John Moore, Bureau Construction Engineer. W. Franklyn Garrett was Resident Engineer.



Extra Hands···to Aid Industry—and You!

HANDLING COMPLEX PROBLEMS in the chemical process industries makes many a purchasing and production executive wish he had as many extra hands as this ancient Hindu idol to help him through—*and he has!*

THEY ARE HIS...and yours—in the cooperation and assistance of chemists, engineers, and technicians on General Chemical Company's Technical and Engineering Service staffs. These experts are well qualified by technical training and by practical industry-wide experience to offer sound, constructive advice in many ways—whether your problems deal with industrial, scientific or agricultural chemicals.

THEY CAN FURNISH pertinent data on properties, grades, and packaging of General Chemical products . . . advise on materials and methods for handling and storing them . . . consult on their applications to your operations,..and work with you in the development of special chemicals to meet your individual requirements.

When "extra hands" such as these can help you, just phone or write to the nearest General Chemical Company Sales and Technical Service Office listed below.

GENERAL CHEMICAL COMPANY

40 RECTOR STREET, NEW YORK 6, N. Y.

BASIC CHEMICALS
GENERAL CHEMICAL COMPANY
FOR AMERICAN INDUSTRY

Sales and Technical Service Offices: Albany • Atlanta • Baltimore • Birmingham Boston • Bridgeport • Buffalo • Charlotte • Chicago • Cleveland • Denver Detroit • Houston • Kansas City • Los Angeles • Minneapolis • New York Philadelphia • Pittsburgh • Providence • San Francisco • Seattle • St. Louis Wenatchee (Wash.) • Yakima (Wash.)

In Wisconsin: General Chemical Wisconsin Corporation, Milwaukee, Wis.

In Canada: The Nichols Chemical Company, Limited
Montreal • Toronto • Vancouver

LUDLOW DOUBLE DISC GATE VALVES

Serve for the Future

Whenever you recommend new water-works valves, you naturally keep your community's needs foremost in mind. You want equipment that will serve efficiently year after year with the least amount of maintenance. And you want to be sure of getting the most for your own — and your neighbor's — money.

By their past performances, LUDLOW Double Disc Gate Valves have proved themselves fit to serve the future of *your* community. In thousands of municipalities all over the country, LUDLOW Valves continue to give constant, faithful service with low upkeep and high resistance to wear. For LUDLOW'S simple — yet rugged — construction assures smooth operation and positive closure — at all times under all conditions.

Get in touch with LUDLOW engineers *first*. You can rely on them to furnish you with honest recommendations and accurate estimates.

▲ A.W.W.A. Double Disc Gate Valve. Iron body, bronze mounted — complying with latest A.W.W.A. specifications. Tested at 300 lbs. hydrostatic pressure. Sizes 2" to 48".

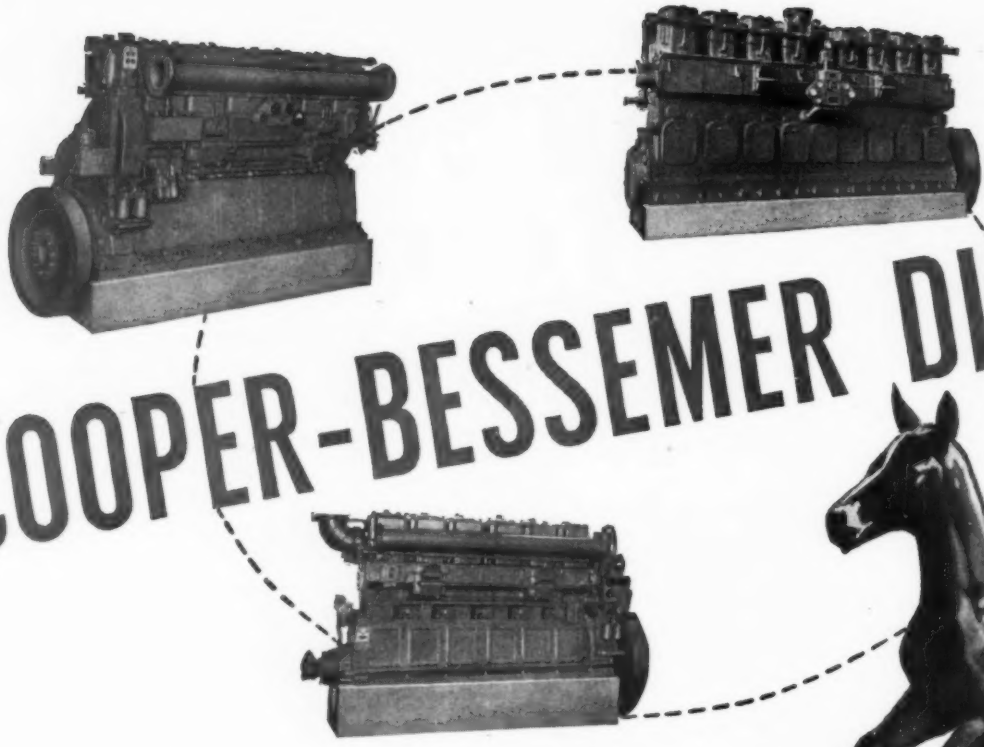
▲ Iron body, bronze mounted low pressure valve. List 3 Valves made in sizes 14" to 60" and can be furnished with Hub and Flanged ends.

◀ Hydraulic cylinder, iron body, bronze mounted — manufactured in all sizes for any desired test or working pressure. Can be operated by four-way cocks or remotely controlled by solenoid valves.

▲ Iron body, bronze mounted, OS&Y. Tested at 350 lbs. hydrostatic pressure. List 44, sizes 2" to 12" 200 lbs. working pressure. List 66, sizes 14" to 48", 150 lbs. working pressure.

V-14

The LUDLOW VALVE MFG·CO· TROY·N·Y· SINCE 1866



COOPER-BESSEMER DIESELS

HORSEPOWER
That Stays "Young" Longer

THERE are a lot of good sound reasons why Cooper-Bessemer Diesels stay "young" and vigorous as a colt for more years than you'd dare expect. There are five reasons that are particularly important.

1. Tough Meehanite Metal takes the place of all ordinary iron castings. It's stronger, is less subject to wear and corrosion, will better withstand all kinds of punishment.

2. Bearings are precision machine-finished . . . and to amazingly close tolerances. Far better than hand finished, hand fitted bearings, they prove their superiority in longer life and less maintenance.

3. Pistons are evenly oil-cooled by Cooper-Bessemer's own Turbu-flow principle, effectively preventing piston distortion, and greatly prolonging life of rings, liners and pistons.

4. Cooper-Bessemer's patented piston pin-to-rod assembly almost doubles the usual bearing area, greatly reducing pressures and multiplying bearing life.

5. Pistons are electroplated to eliminate scuffing, to minimize friction, and to assure perfect breaking in for a long healthy life.

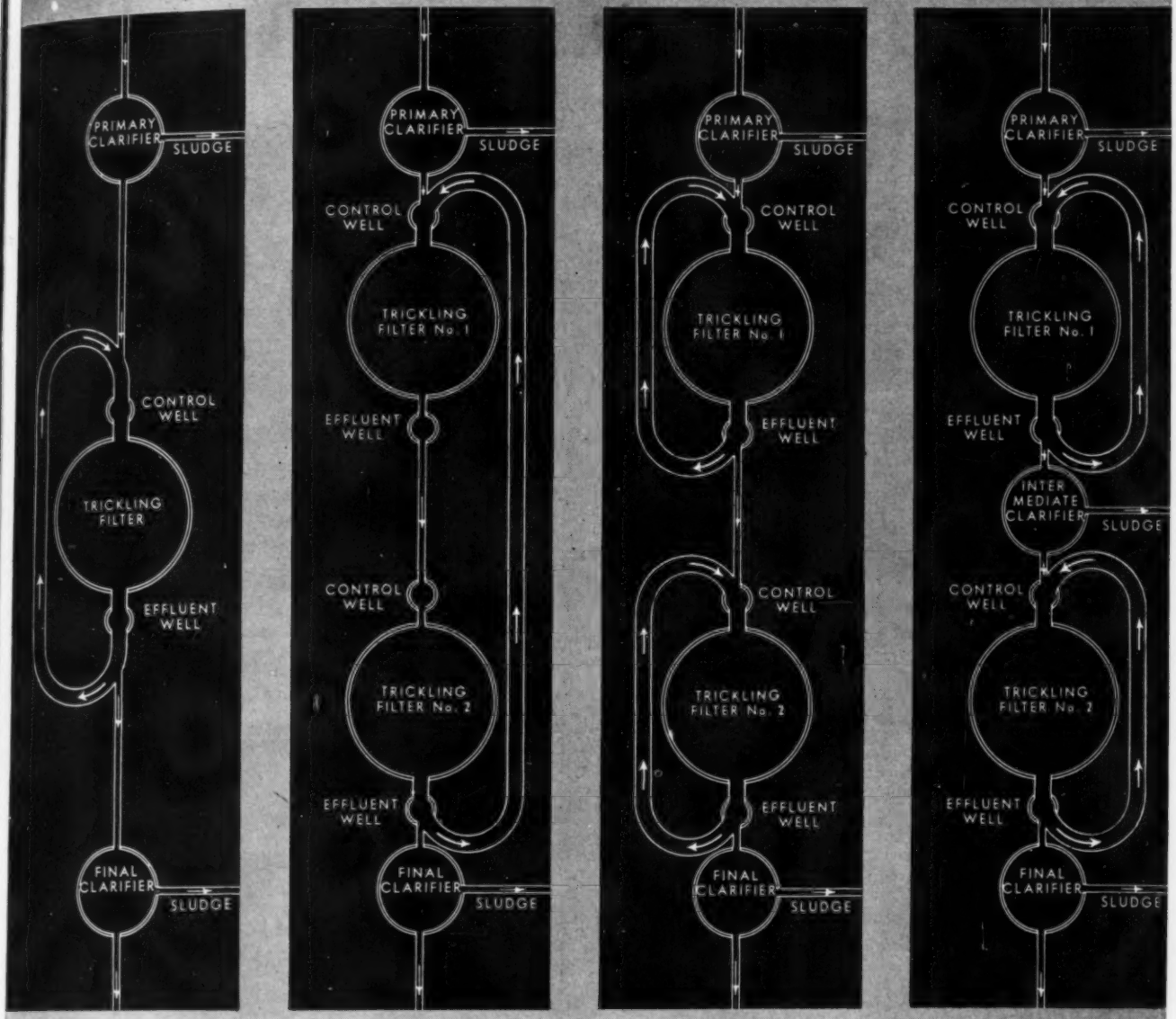
The Cooper-Bessemer office nearest you will be glad to give you more reasons why these modern Diesels offer you exceptionally fine service and unusually low operating cost. There are Cooper-Bessemer Diesels for every type of service from 100 to 1800 horsepower.

The
Cooper-Bessemer
Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York Washington Tulsa Dallas Seattle
St. Louis Houston Los Angeles Shreveport
Calmes Engineering Company, New Orleans, La.

ACCELO-FILTER FOR SEWAGE TREATMENT



DIRECT RECIRCULATION

Increases biological treatment efficiency without necessitating any increase in size of either primary or final sedimentation tanks.

Ask for Bulletin 6200.

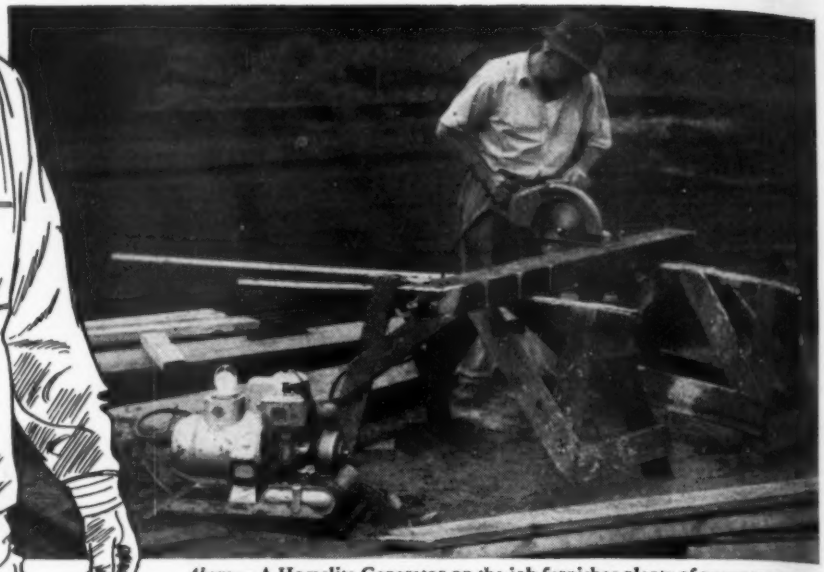
INFILCO

INFILCO

INCORPORATED

325 WEST 25th PLACE • CHICAGO 16, ILL.

Their Performance Speaks Louder Than Words



Above — A Homelite Generator on the job furnishes plenty of power to operate time-saving electric saws.

Below — A Homelite Pump and Generator make the right combination for speeding dewatering jobs at night.

We'd much rather show you Homelite Portable Gasoline-Engine-Driven Pumps and Generators *in action* than just talk about them. Action speaks louder than words.

So why not let us give you a free demonstration... any place you want it. See how fast a Homelite pumps, how quickly it primes itself, how easily it handles heavy liquids and solids. See all the cost-cutting operations you can put to good use on day or night work with steady electric power furnished by a handy Homelite Generator.

To get such a demonstration, free from all obligations, simply write. We'll have our nearest representative get in touch with you.

Homelite
CORPORATION
Port Chester, New York
Portable Pumps Generators and Blowers
GASOLINE-ENGINE-DRIVEN

We won't bore you

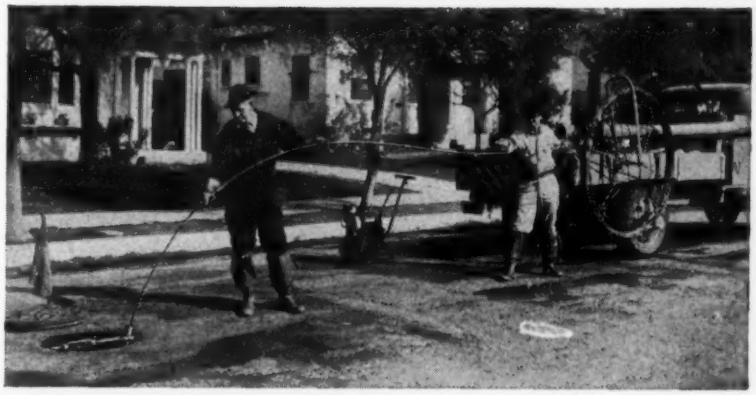
WITH all THE ADVANTAGES OF FLEXIBLE—BUT...

There have to be some mighty good reasons why 78% of the nation's cities equip their Sewer Departments with Flexible Sewer Rods.

FLEXIBLES PAY FOR THEMSELVES. Flexibles will actually pay for themselves five times each year because three men can clean more pipe in a day with Flexible Equipment than an entire crew working with old style equipment.

FLEXIBLES ELIMINATE UNSANITARY WORK. Dig-ups are seldom necessary when Flexibles are used. Men work at street level through manholes and eliminate that hot, unsanitary part of the job. There is a Sewer Rod tool to handle any pipe cleaning job.

FLEXIBLES CLEAR ANY PIPE STOPPAGE. No matter what causes the pipe stoppage, whether it is caused by rocks, roots, or sand deposits, Flexibles bore right through and clear the line. It's this boring action that makes Flexibles so effective. Let Flexible show you the modern Flexible method of cleaning pipe. Write for illustrated catalogue today.



Flexibles permit men to work effectively at street level. Workman is shown placing the Flexible tool in the line through a manhole with the aid of a rod guide.

When corkscrew reaches obstruction, rod is disconnected from reel. Flexible Power Drive is then connected to turn corkscrew into obstruction.

Flexible Power Drive turns rod at speed 5 times faster than that possible by hand turning.

855 Board of Trade Bldg., Chicago 4, Ill.
228 W. Broad St., Columbus 8, Ohio
1624 Marmon Place Minneapolis 3, Minn.
P.O. Box 185 Atlanta.
P. O. Box 447, Lancaster, Texas
41 Greenway St. Hamden, Conn.
147 Hillside Ter., Irvington, N. J.
P. O. Box 894, Pittsburgh.
401 Broadway, New York 13.
29 Cordan Ave., Roslindale 31, Mass.

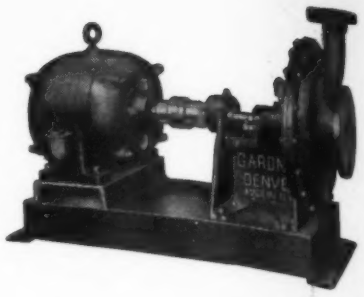
Flexible SEWER ROD EQUIPMENT CO.

9059 VENICE BOULEVARD • LOS ANGELES • CALIF.

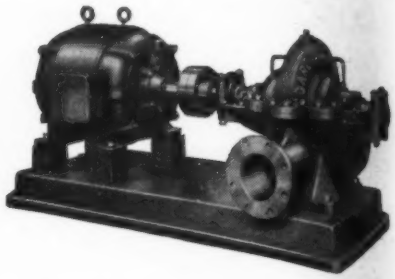
In the *Higher Efficiency* Brackets...

The smoothness and evenness with which water flows through your pump has a lot to do with pumping costs. In Gardner-Denver centrifugals, rigidly controlled foundry practices assure absolutely smooth water passages. Furthermore, these passages are properly proportioned to eliminate unnecessary eddies, back-waters and sudden changes in velocity. This—plus the inclusion of every other worthwhile hydraulic and mechanical feature—is why Gardner-Denver centrifugals are in the higher efficiency brackets. For complete information, write Gardner-Denver Company, Quincy, Illinois.

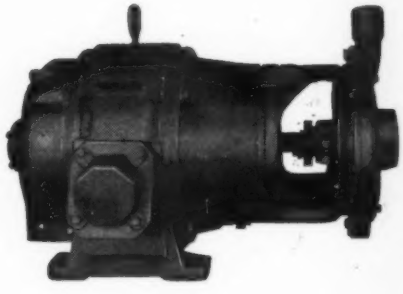
GARDNER-DENVER
Since 1859



Side Suction. *Designed for general service, these Gardner-Denver Side Suction Pumps are low in first cost, as well as in installation costs. Capacities up to 2.3 million gallons per day, or 1600 gallons per minute, can be handled in heads up to 100 feet.*



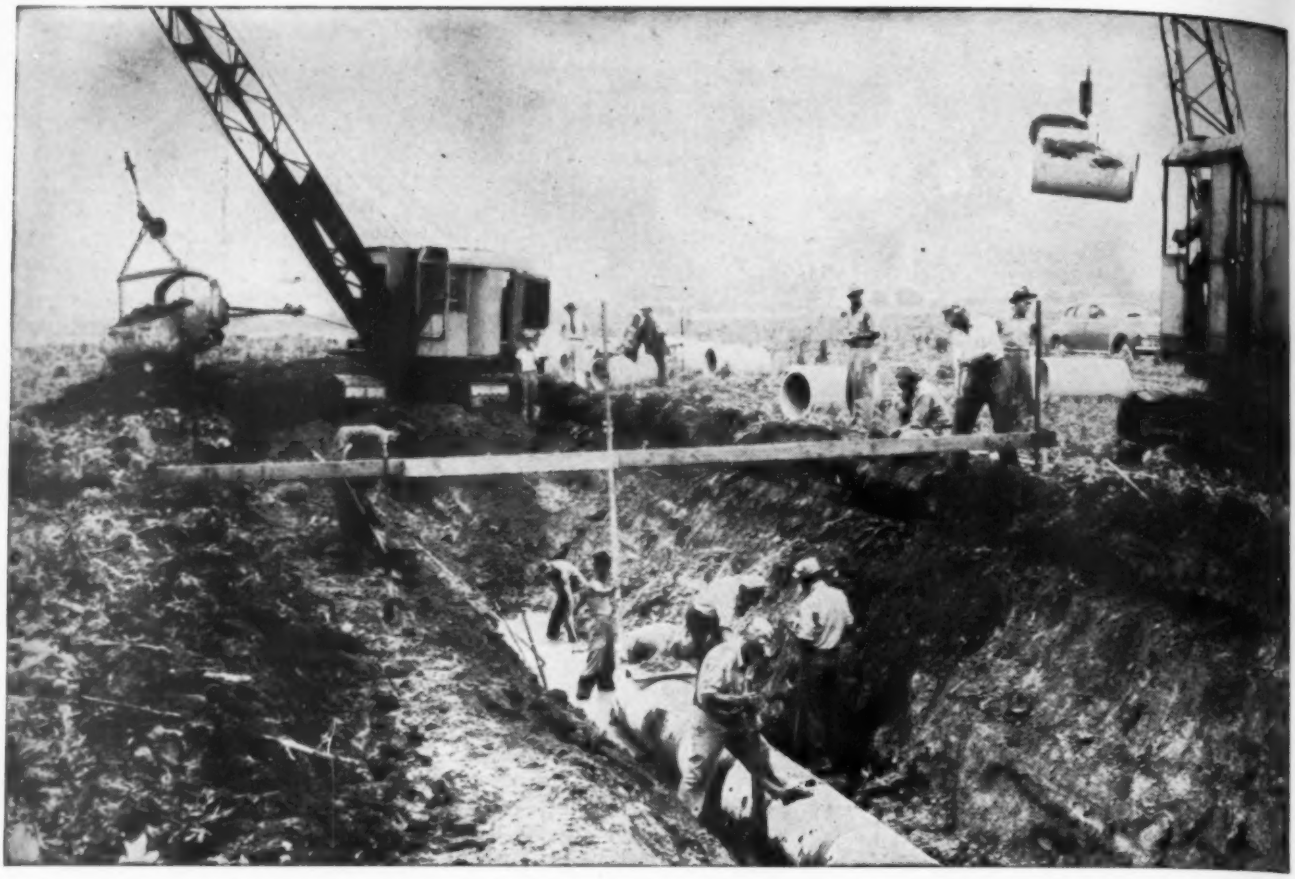
Double Suction. *Gardner-Denver Double Suction Single-Stage Centrifugal Pumps cover all heads up to 300 feet. These pumps have a horizontally split case for easy accessibility. Wearing rings are easily checked. The entire rotor assembly can be removed without disturbing the motor or piping, or exposing the bearings.*



Close Coupled. *In these Gardner-Denver Centrifugals, pump and motor are combined to form a complete, compact unit. Pumps can be installed in any position—on floor, wall or ceiling. These centrifugals are designed for capacities up to 250 gallons per minute, and heads up to 250 feet.*

COLUMBIA CHEMICALS

PITTSBURGH PLATE GLASS COMPANY
COLUMBIA CHEMICAL DIVISION
FIFTH AVENUE at BELLEFIELD • PITTSBURGH 13, PA.
CHICAGO • BOSTON • ST. LOUIS • PITTSBURGH • NEW YORK • CINCINNATI • CLEVELAND
PHILADELPHIA • MINNEAPOLIS • CHARLOTTE • SAN FRANCISCO



CONCRETE PIPE LINES

For Adequate Airport Drainage

24-in. concrete pipe line being installed for drainage system of new Municipal Airport at Springfield, Ill. More than four miles of reinforced concrete sewer and culvert pipe is going into this project in sizes from 8-in. to 48-in. diameter. Contractor is Wright Construction Co., Williamson, Mich. The airport is being built by Civil Aeronautics Administration under the sponsorship of the Springfield Airport Authority.

CONCRETE PIPE lines have the strength and durability to resist loads and impacts and render long years of economical service. Reasons enough why hundreds of miles of concrete pipe are serving efficiently in the drainage systems so essential to modern airports.

In addition to strength and durability, concrete pipe complying with Standard Specifications of the American Society for Testing Materials or the American Association of State Highway Officials, have the further advantages of:

MAXIMUM CARRYING CAPACITY, assured by smooth invert line which minimizes turbulence and abrasion when suspended grit is present.

MINIMUM LEAKAGE AND INFILTRATION, assured by tight joints and uniformly dense concrete.

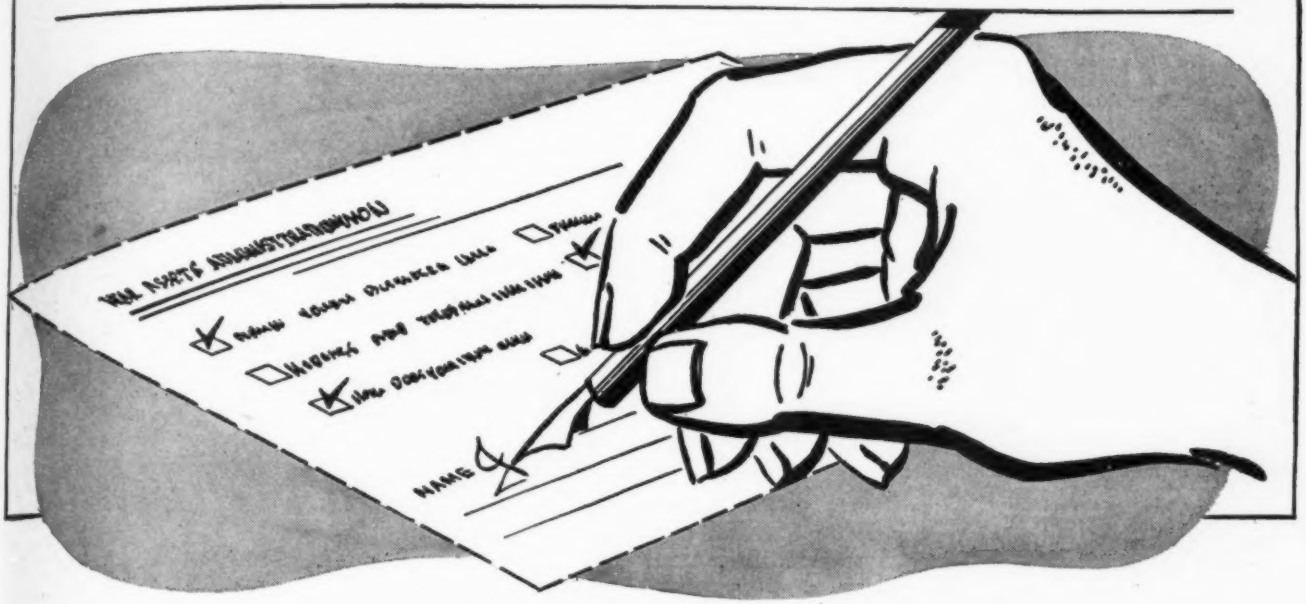
These characteristics mean that concrete pipe lines give many years of service at low maintenance expense, resulting in *low annual cost*—the true measure of economy in pipe lines whether for drainage, sewerage or water supply projects.

PORTLAND CEMENT ASSOCIATION

Dept. 10-29, 33 W. Grand Ave., Chicago 10, Illinois

A national organization to improve and extend the uses of concrete
. . . through scientific research and engineering field work

..GOVERNMENT-OWNED SURPLUS PROPERTY..



How to Locate Short Supply and Special Items of

INDUSTRIAL CHEMICALS

IF you need hard-to-get industrial chemicals, why not contact your War Assets Administration Regional Office? If what you are looking for is not in local supply, the WAA has set up a special Inter-Regional Sales Division to help find it for you—*quickly*—if it is available anywhere in the country.

Remember, there are hundreds of items in the vast stock pile of War Surplus industrial chemicals, many *at below-market prices!* Among them you may find the chemicals *you* want. All items are ready for quick sale and you may arrange convenient credit terms. Your nearest WAA Regional Office is listed below. Write today—or use the coupon below.

ONCE-IN-A-LIFETIME BUYS!

- Acids
- Gas cylinders (all types)
- Dyes and intermediated
- Plastic materials
- Solvents
- Sealing and caulking compounds
- Zinc carbonate
- Picric acid
- Welding fluxes
- Detergents and cleaners
- Water treating compounds
- Calcium chloride
- Dimethylaniline
- Coal-tar
- Borax and boric acid
- Metal salts, oxide and hydroxides
- Pitches
- Gases
- Rubber processing chemicals
- Copper naphthenate
- Synthetic & natural glues
- Printing inks (black & colors) and most other chemicals

FREE FACTS

War Assets Administration (address nearest Regional Office)

Please supply without obligation, prices, available quantities and locations of items written in below:

....

....

....

.....

(Describe item wanted)

Name..... Tel. No.....

Firm.....

Address.....

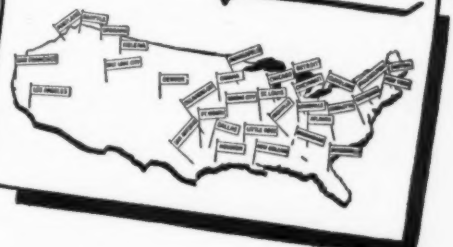
City..... State.....

155-5

All chemicals are subject to priority regulations. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area and then to purchase the material offered herein.

Much surplus property is available to the export market. Merchandise in short supply is withheld from export, and if such items appear in this advertisement they will be so identified by an asterisk.

33 REGIONAL OFFICES TO SERVE YOU



WAR ASSETS ADMINISTRATION

GOVERNMENT OWNED SURPLUS

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha • Philadelphia • Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane

Complete Automatic Control for Pumping Stations . . .

IN A SINGLE, COMPACT UNIT

In planning modern instrumentation for a pumping station, consider this compact, pre-assembled Foxboro Control Unit. It is easy and quick to install – requires no technical skill. It is designed to operate at top efficiency with the least amount of attention.

This control unit consists of the following better-engineered Foxboro Instruments . . .

1. **Indicating Altitude Controller** . . . automatically starts and stops pumps on demand from elevated storage tank by pressure control. Also operates signal lights, proportioning pumps, or other auxiliary electric equipment.
2. **Flow Recorder (Master Meter)** with pressure pen and integrator . . . not only shows pump output and head of water, but also keeps an accurate record of these operations for day-to-day comparison and for insurance rating.
3. **Liquid Level Instruments** . . . for draw-down or clear well measurement. Indicating (as illustrated) or recording.

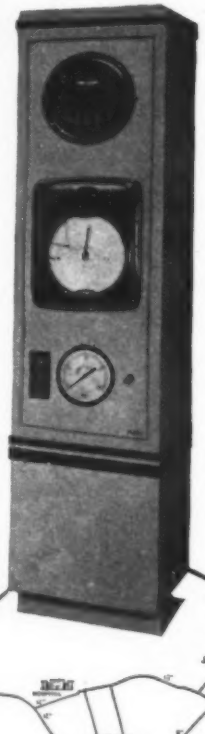
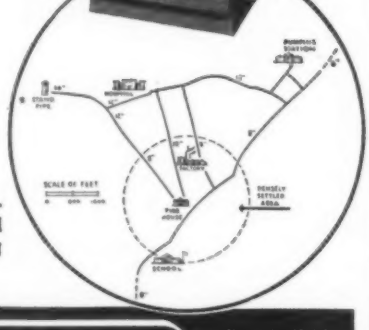


Photo also shows hand pump for draw-down indicator, and hand-off automatic switch for pump operation. Other accessories provided as needed.

Foxboro Engineers will be pleased to furnish specifications and to cooperate with consulting or operating engineers. Descriptive literature, on request. Write **The Foxboro Company, 228 Neponset Avenue, Foxboro, Mass., U. S. A.**



Typical water system layout controlled by Foxboro Pumping Plant Station

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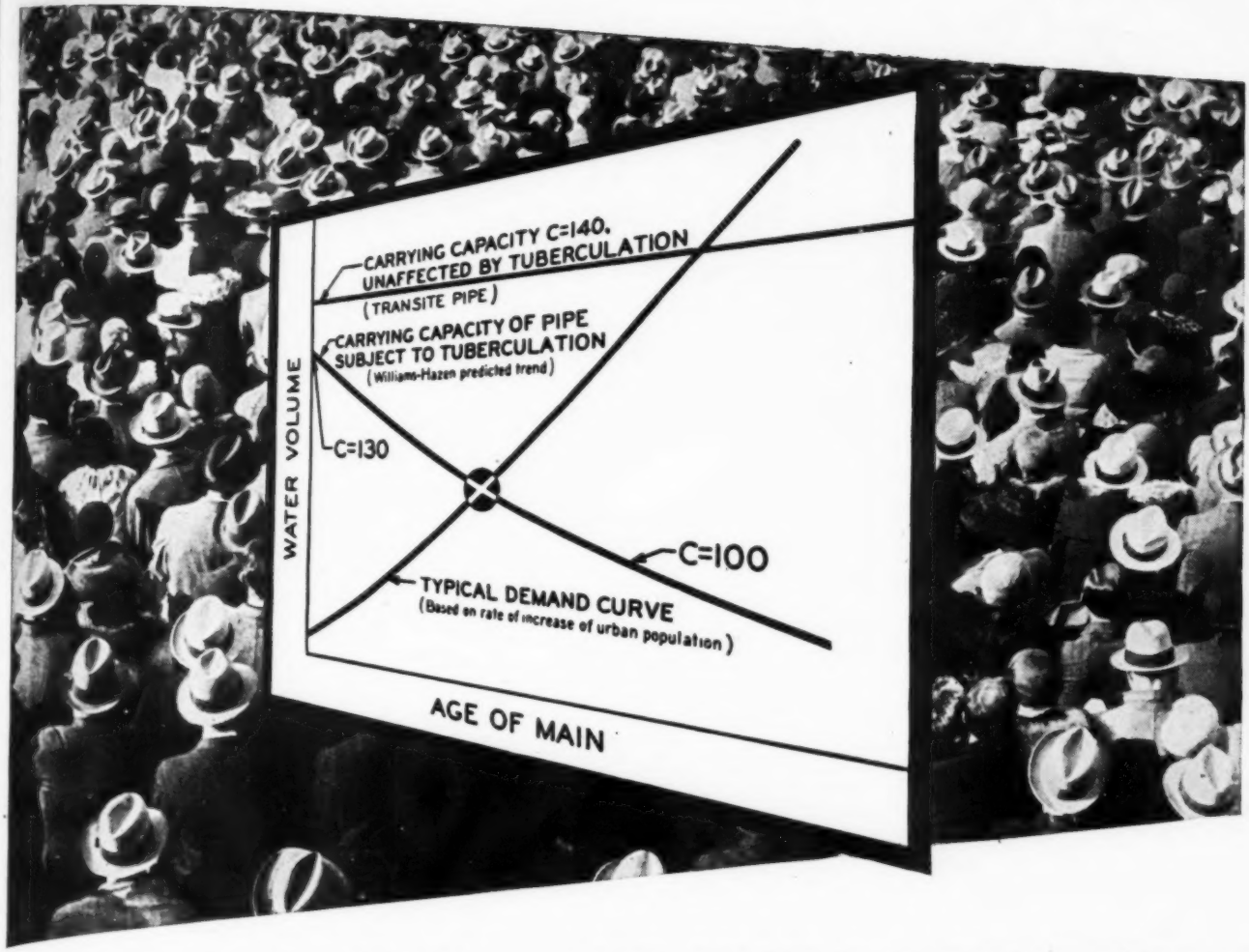

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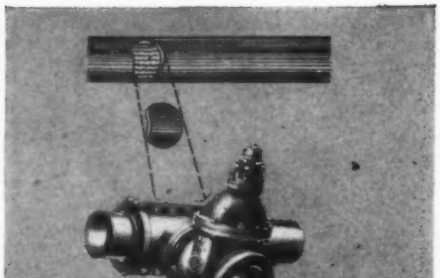
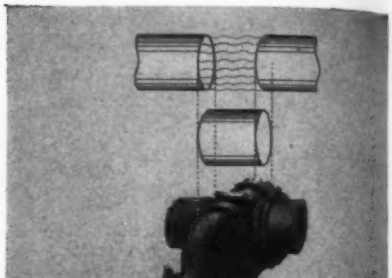
Gate Valves, **for low, medium or high pressure service. Manual, hydraulic cylinder, or motor operation.**



Tapping sleeves, **for making branch connections (in sizes 2" thru 42") under pressure in cast iron, steel, asbestos-cement or reinforced concrete pipe of any size.**



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Pipe Cutting Machines. **With the SMITH machine a true "lathe" cut can be made on cast iron, steel or asbestos-cement pipe in a minimum time.**

Water service brass goods: **corporation —curb cocks, couplings and other fittings for copper tube, lead and iron pipe services.**

Corporation Tapping Machines. **With the SMITH Tapping Machines corporation cocks can be installed under pressure. The machine is compact and easy to operate.**

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13

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COMING!

"Public Relations and the Sewage Treatment Plant"
Is an article setting forth what every sewage works superintendent and operator should find of moment in establishing and maintaining good relations with the public, including officialdom as well as the taxpayer. Containing practical advice, based on time tested experience, this article was sought of a former water works superintendent and now an acknowledged master of public relations in sewage treatement—
WALTER A. SPERRY, Supt. & Engr.,
Aurora Sanitary Distr., Aurora, Ill.

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Is just what the title signifies as applied to water utility properties. Those of our readers who are familiar with the earlier lucid presentations of the author of this discussion of a highly important phase of water works economics and financing will be watching for this valuable contribution and reference article by—
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Michigan Stream Control Comm., Lansing, Mich.

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May be caused by galvanic action water line corrosion, carbon dioxide, or stray currents, but, whatever the cause it is costly. Both the problem and the remedies are discussed by—
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State Water Survey, Urbana, Ill.

"Solving Scum Problems"
Although sewer problems vary with the nature of the sewage being treated and the plant design, there are certain basic things that can be done to control scum. These are set forth by an operator who has been successful in solving the scum problem.
JOSEPH DOMAN, Supt.,
Sewage Treatment Plants, Greenwich, Conn.

"Improving Water Plant Operation"
The third of a series of articles on this topic deals with the problem of low-temperature coagulation, with particular reference to the effectiveness of activated silica as a coagulation aid in cold weather, when rapid and efficient flocculation is most difficult and tender floc becomes a problem. The author of "New Concepts of Coagulation" and the current series of helpful advice is—
HAROLD R. HAY, Chemical Engr.,
The Philadelphia Quartz Co., Philadelphia.

"Modern Practices in Municipal Water Softening"
The title of which pretty much tells the story, which brings up-to-date the water softening practices of today. The contributor of this request article is—
S. B. APPLEBAUM, President,
Liquid Conditioning Corp., New York.

"Hydraulics for the Practical Water Works Man"
Is a continuing series of articles by Prof. R. W. Angus of Toronto. Unfortunately this issue had to go to press ahead of the regular schedule and Dr. Angus' contribution was not received in time to be inserted. Watch for it in November.

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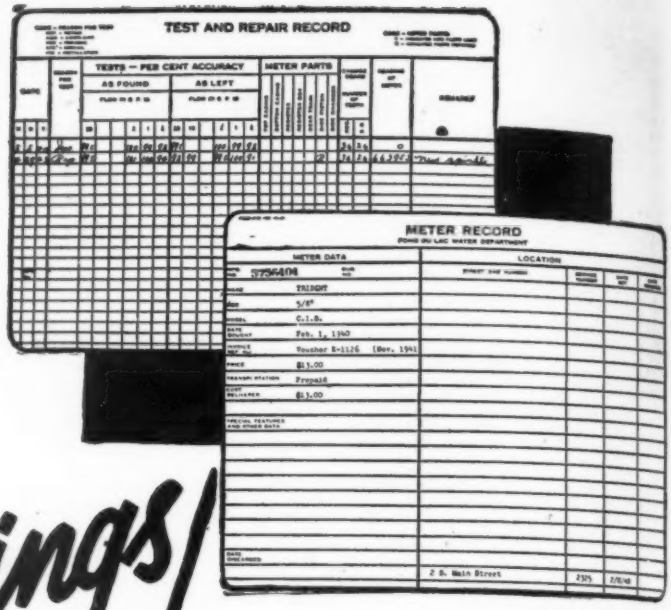

At Fond du Lac, Wis., one of these cards is made out for each new meter, and a complete record of the meter's history is kept, ending decades later with the entry "data discarded."

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WATER & SEWAGE WORKS

VOL. 93, No. 10 OCTOBER, 1946

A Gillette Publication

GRAND CANYON'S UNIQUE WATER PUMPING PLANT

Some Operating Results During Thirteen Years of Lifting Water 3150 Feet

By GEORGE L. DAVENPORT, JR.
Hydraulic Engineer
A. T. & S. F. RY. CO.
LOS ANGELES, CALIF.

IN 1932 The Atchison, Topeka and Santa Fe Railway Company constructed a pumping plant with a static lift of 3150 feet at Grand Canyon, Arizona.

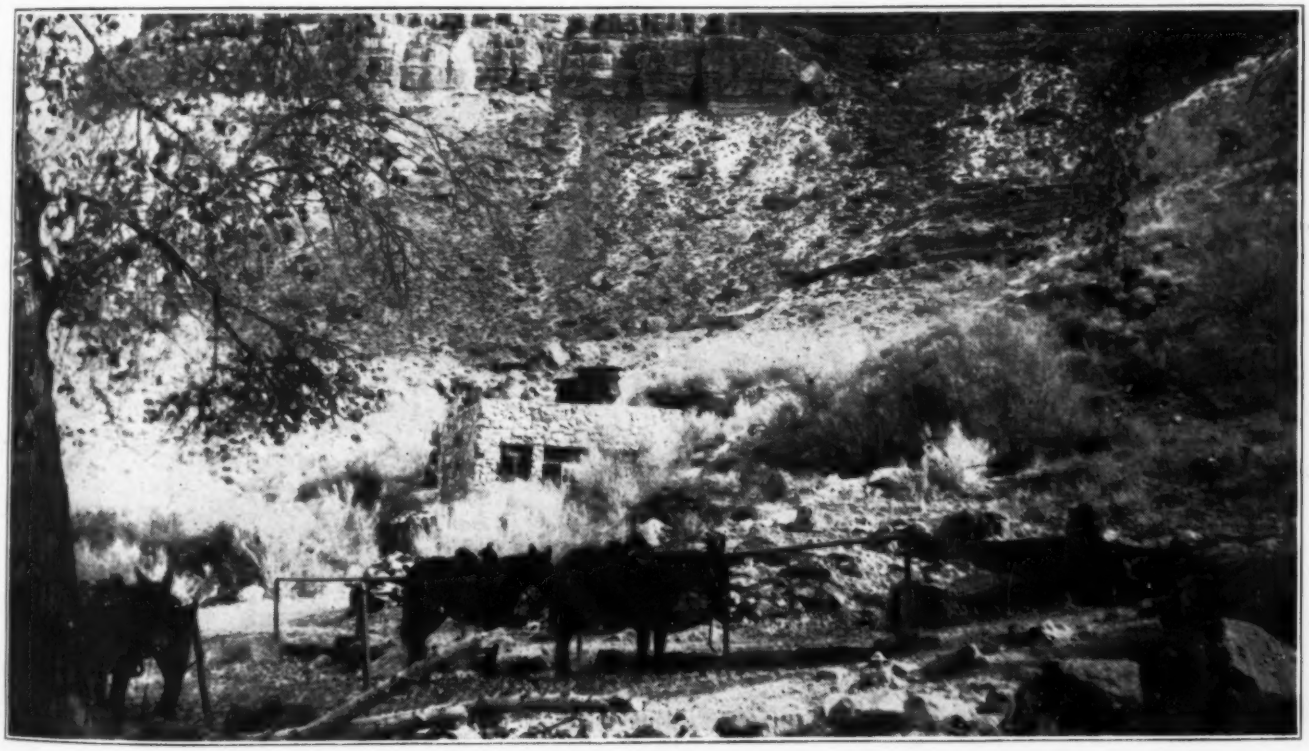
Formerly all fresh water for use of hotels, locomotives and other railroad or Park Service use was hauled in in tank cars from Flagstaff, 98 miles away.

By construction of a pumping plant at Indian Gardens Springs on the plateau some 1200 feet above the Colorado River and 3150 feet below the rim of the Canyon, water was made available to service on the South rim of the Canyon through 12,000 feet of 6 inch pipe line.

Pumping Plant

Originally four vertical centrifugal turbine type pumps were installed in two sets, with two pumps to each set, which had a capacity of 85 gpm. against a head of 3300 feet.

Each pump had 17 stages, thus providing 34 stages for each pump



Indian Gardens Pumping Station 3150 ft. Down in the Canyon, but Still 1200 ft. Above the Colorado River.
(Note the sure-footed safe canyon-mule transport at the hitching rail.)

An Almost Vertical Climb of the 6 in. Main, 3150 ft. Up and 12,000 ft. in Length

Constructed of seamless steel tubing with wall thickness of better than ¼ inch minimum, to almost 1/3rd inch in the lower section designed for 1500 lbs. working pressure. Jointing consists of forged rubber-gasketed bolted couplings tested to 5000 lbs. pressure.

set, as the two pumps in each set operated in series.

The pumps were operated by 60 hp. 2 pole 60 cycle 3520 rpm. 2300 volt vertical motors. Automatic starters limited the starting current to 140% of running current.

Later, a third and larger pump set was added and one of the original sets was replaced with a larger set. At the present time the pumping plant consists of one set of 85 gpm. pumps with 60 hp. motors and two sets of 160 gpm. pumps with 100 hp. motors. The larger pumps each have 14 stages, making 28 stages per pump set with two pumps operating in series.

Water flows to the pump suction under a positive head of 18 feet from a two compartment 70,000 gallon concrete reservoir 38 feet in diameter by 10 feet deep which is kept supplied from springs.

Remote Control

The pumping plant is operated from the rim power house by push buttons, using a supervisory control system over two wires and thus permitting the starting and stopping of any one or more pump sets.

Alternating current at 2300 volts 60 cycles is transmitted from conductor 250,000 - CM armored cable. A separate armored cable carries the supervisory control over two No. 10 wires.

the rim power house over a three

It was originally planned to have a service man visit the pump house once a week but this has been changed to once in two weeks. With this exception, there are no attendants at the plant.

Water flow comes principally from several nearby springs and is delivered to the reservoir partly by gravity and partly by pumping.

At the Lower Indian Gardens spring pumping plant, 2000 feet distant from and at 200 feet lower elevation than the main reservoir, there are two automatic turbine pumps of 130 gpm. capacity which discharge to the reservoir through a 6 inch cast iron line.

Electric Eye Prevents Pumping of Turbid Water

While clear water from springs is normally intercepted by a submerged dam and handled by these auxiliary pumps, there are times when storms bring silty water to the intake pump. To prevent handling of this silty water, which might damage the main high pressure pumps if it reached the reservoir, a photo-electric cell, or "electric eye," was later installed in the intake to the pump sump. This controls hydraulic valves which automatically divert silty water, allowing only clear water to reach the pumps.

Automatic Remote Controlled Indian Garden Pumps.

Equipment consists of turbine type pumps of which there are three sets. Each set consists of two pumps connected in series. The 160 gpm. pumps (two sets) of 14 stage bowls give 28 stages in the series hook-up to deliver against almost a 3500 ft. head, and are driven by 100 hp. motors.

In spite of all precautions taken to insure practically clear water the main high pressure pumps have had to be repaired at intervals of from 1½ to 2 years to maintain good efficiency. The original pumps had no wearing rings, while later pumps have been equipped with both impeller and case wearing rings having ground stellited surfaces. These improvements have reduced repair cost, but it has been found necessary to keep on hand complete sets of rotating elements for quick replacement while those taken from the pump are being reconditioned.

However, the repair cost of the pumps has only averaged 2.4% of the total water cost; and, as all transportation to and from the plant is by mule or hand cart on a steep canyon trail, the installation of pumps with relatively light replaceable wearing parts has been shown to be well justified.

Reliability of the pumping plant has been such that no return to tank car haul, even for short intervals, has been necessary.

480,000,000 gallons of water have been handled by the pumping plant to date.

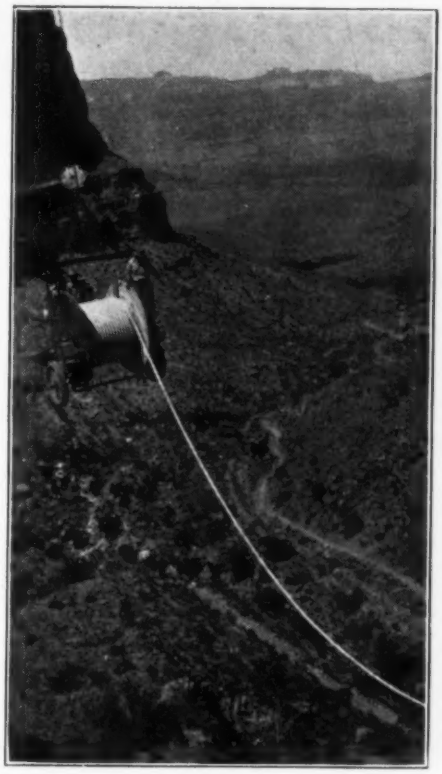
Pipe Line of Unusual Wall Thickness and Gasketed Couplings

Six inch galvanized seamless steel tubing of 0.28 inch standard wall thickness, and with upset ends, was used for the upper section of the discharge line where pressures did not exceed 1000 lbs. psi. The lower section, designed for working pressures up to 1500 lbs. psi., was of the same nominal size and description except that it had a wall thickness of 0.3125 inches and was made of 90,000 lb. instead of 60,000 lb. steel.

Forged steel couplings with rubber gaskets and two holding bolts were used. Gaskets for the lower portion of the line were tested to 5000 lbs. pressure.

The pipe was supplied in 30 foot sections and all bends were shaped cold in the field to fit rugged terrain with vertical cliffs as high as 280 feet in some locations. About 93% of the pipe was buried and protected against soil corrosion by coal tar or petrolatum coating followed by wrapping.

The other 7% was left exposed on cliffs and was painted to match the color of the rocks so that it has remained practically invisible.



Safe from Rattle Snakes!

Was this exciting method of laying armored electric cable from the power house down the canyon to the Indian Gardens Pumping Station. The line carries 2300 volts. A separate cable carries the supervisory control circuits.

As temperature near the rim sometimes goes down to 20 deg. F. below zero, provision was originally made for draining the line through a distant controlled needle valve at the bottom. Also a thermostat was set in the pipe line just below the rim with an electric circuit to a warning bell and light signal in the power house.

No need has ever been found to drain the pipe line as the warning signal from the thermostat warning signal enables the power house operator to start up a pump to put the water in motion so it will not freeze.

In the thirteen years of operation no leaks have been found in either the pipe or the couplings and all the rubber gaskets have remained water tight.

Inspection of the pipe exterior at various points in the buried portion after ten years of service showed no appreciable deterioration of either pipe or wrapping.

Transportation

Light repair parts up to 150 pounds can be carried down the trail by mules.

When heavier repair parts have to be transported use is made of a specially built hand cart.

This has two rubber tired wheels, each equipped with a separate hand operated brake, and it has a wood tongue for steering. Three men operate the cart down the steep trail, one man steering it around the sharp bends and the other two applying the brakes. In this way articles up to 2000 pounds, and not exceeding 8 feet in length, can be transported downhill.

The cart is taken apart and loaded on mules for the return trip to the rim.

Zeolite Softening and Chlorination

On arrival at the Canyon rim power house the water from the Indian Gardens pumps passes through pressure type zeolite treating tanks which are provided in three units. These soften the water to practically zero hardness before it passes on to the storage tanks of one million gallons combined capacity.

Care is taken to backwash the zeolite mineral with sufficient water to bring the salt content of the rinse water to within five grains of the salt content in the raw water before the units are put back on the line. This precaution has been found essential in preventing excessive corrosion from use of zeolite treated water. A duplicate set of semi-automatic chlorinators in the power house sterilize the water before storage.

General

The operation of this high pressure pumping plant has proven very successful during thirteen years of operation and shows no sign of depreciation which cannot be overcome by normal maintenance. The much greater reliability of a triple unit plant over that of a duplicate unit installation has been demonstrated.

With the end of the war and consequent resumption of tourist travel to Grand Canyon, need for an increased water supply will soon make it necessary to either haul in extra water from distant points or else develop an additional supply within the Canyon.

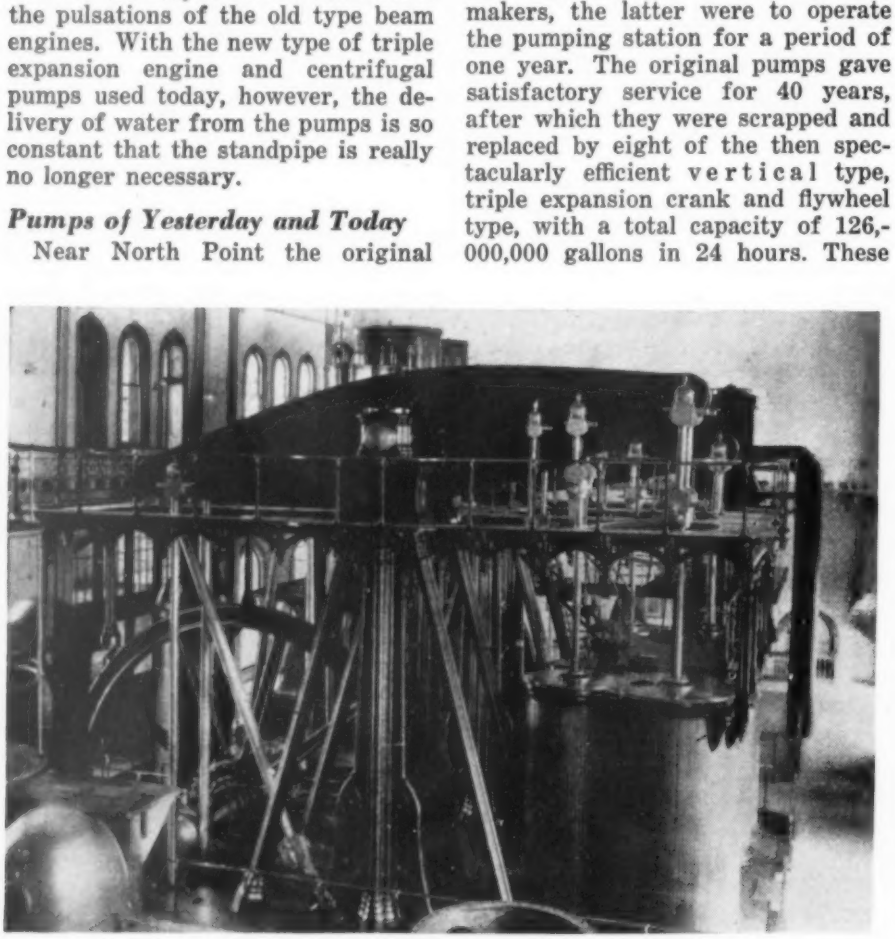
MILWAUKEE'S 73-YEAR OLD WATER TOWER GETS FACE LIFTING

By JOHN E. HUBEL
MILWAUKEE, WIS.

THE old North Point water tower on Milwaukee's lake front, erected in 1873, although having outlived most of its usefulness, is being freshened up this year, as it is considered a work of architectural beauty. Still containing a standpipe 4 feet in diameter, about 125 feet in height and open at the top, it is now serving mainly as a means of permitting air to escape from the system. The water tower itself (see cover picture*) is 175 feet in height. Its original use was to relieve the city water mains from the pulsations of the old type beam engines. With the new type of triple expansion engine and centrifugal pumps used today, however, the delivery of water from the pumps is so constant that the standpipe is really no longer necessary.

Pumps of Yesterday and Today

Near North Point the original pumping station still stands, with modifications and enlargements in later years. The original pumping equipment, no longer used in the pump house at the lake front, was the last word in such machinery when the water tower and pumping station were erected in 1873. It consisted of two compound condensing beam and flywheel pumping engines, each with a capacity of 8,000,000 gallons in 24 hours. Both were coupled to one flywheel, arranged so that they could be operated together or separately. They were at the time the pride of the water works industry and were built by the E. P. Allis Co., the forerunner of the present Allis-Chalmers Mfg. Co. Under one of the conditions of the contract made by the city with the pump makers, the latter were to operate the pumping station for a period of one year. The original pumps gave satisfactory service for 40 years, after which they were scrapped and replaced by eight of the then spectacularly efficient vertical type, triple expansion crank and flywheel type, with a total capacity of 126,000,000 gallons in 24 hours. These pumping engines were also products of the E. P. Allis Co. Four of the eight pumping engines at the North Point plant are low service pumps, capable of pumping water to an elevation of 165 feet, and the other four are high service type, being able to pump water to a height of 275 feet.



Milwaukee's Earliest Pump—One of a Pair

Known as the Striding Beam Compound Pumping Engines, they were manufactured in 1873 by the Edw. P. Allis Co. of Milwaukee—now Allis-Chalmers Mfg. Co.

The bottoms of the pump wells are 14 feet lower than the level of the lake, so that the water from the intake tunnels flows by gravity to the pump wells as fast as the pumps can draw it out. If none of the pumps were working, the water in the wells would stand at lake level. After passing through the pumps, the water is discharged into five force mains, from 30 to 42 inches in diameter.

In addition to the North Point Pumping Station described above, a new pumping station, the Riverside, on the west bank of the Milwaukee River, about two miles from the lake, was put into operation in 1924. The six pumps in this station have a total pumping capacity of 184,000,000 gallons in 24 hours. One of these pumps is of the low service type, capable of pumping water to an elevation of 170 feet, while the other five pumps can elevate the water to 280 feet. Four of the pumps have engines of the triple expansion crank and flywheel type and two are turbo-centrifugal units. Water is taken by gravity from the Linnwood Avenue intake to the suction side of the pumps and it is discharged into a 42 inch main. The discharge of each two adjacent units joins into a 54 inch force main in front of this station. The boiler room at this station contains six 400 h.p. horizontal water tube boilers. At North Point and Riverside stations the water pressures run from 63 p.s.i. low to 120 p.s.i. high.

Distribution Storage

In addition, a booster station is located in the Menomonee Valley. This contains a 30,000,000 gallon electrically operated centrifugal pump. Near this station there is a 6,000,000 gallon ground level tank that is filled during the night under normal pressure. From this storage tank water is pumped directly into large feeder mains at increased pressure. Provision has been made for expansion of this booster station for an additional 6,000,000 gallon storage tank and three additional pumping units of 30,000,000 gallons daily capacity each.

Then there is the reservoir in Kilbourn Park, several miles from the

*A *Milwaukee Journal* Photo.

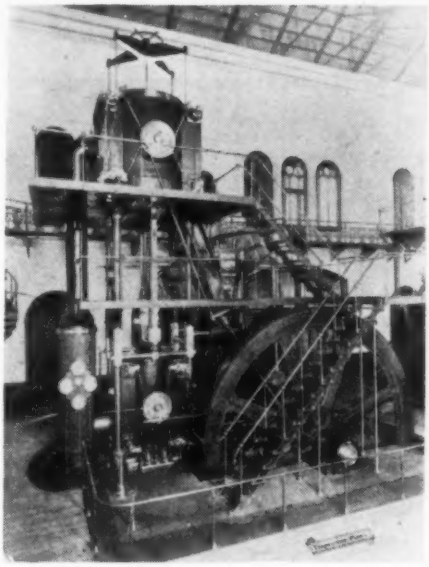
North Point Pumping Station, which is not for storage but for equalizing the water pressure in the low service district, taking care of excess demands in this section during peak consumption. This reservoir is of irregular shape, having an average width of 310 feet; average length, 515 feet, and with a capacity of 24,770,000 gallons. The depth is about 24.4 feet when filled, and the elevation of the water at this height is 152.84 feet above city datum.

The pipe distribution system is of the grid-iron type, the water mains being cross-connected with the mains laid in cross streets. At half-mile intervals larger mains are laid, usually from 8 inches to 16 inches in diameter, and between these mains pipes of 6 inch diameter are laid, forming a grid-iron system. Large feeder mains from 20 inches to 54 inches in diameter are also extended along certain streets to the outskirts of the city and connected to the larger distributing mains for the purpose of reinforcing the pressure lost by friction in the smaller mains. These feeder mains are not tapped for service connections.

Some water mains in the city are of 4 inch diameter, but this size has been discontinued, the minimum size now being 6 inches. Gate valves are set at nearly every street intersection for the purpose of shutting off the water supply in case of leaks or for making repairs. Water mains are laid at a depth of 6 feet for protection against frost. Prior to January 1, 1936, so-called extra strong lead service pipes were used for ¾ to 1¼ inch size, lead or copper tubing for the 1½ and 2 inch sizes, and cast iron for 3 to 6 inch. After the date mentioned, the use of extra strong lead pipe or copper tubing has been optional for the ¾ to 1 inch services. For the 1¼, 1½ and 2 inch, only copper tubing is permitted, while for the 3, 4 and 6 inch services only cast iron may be used.

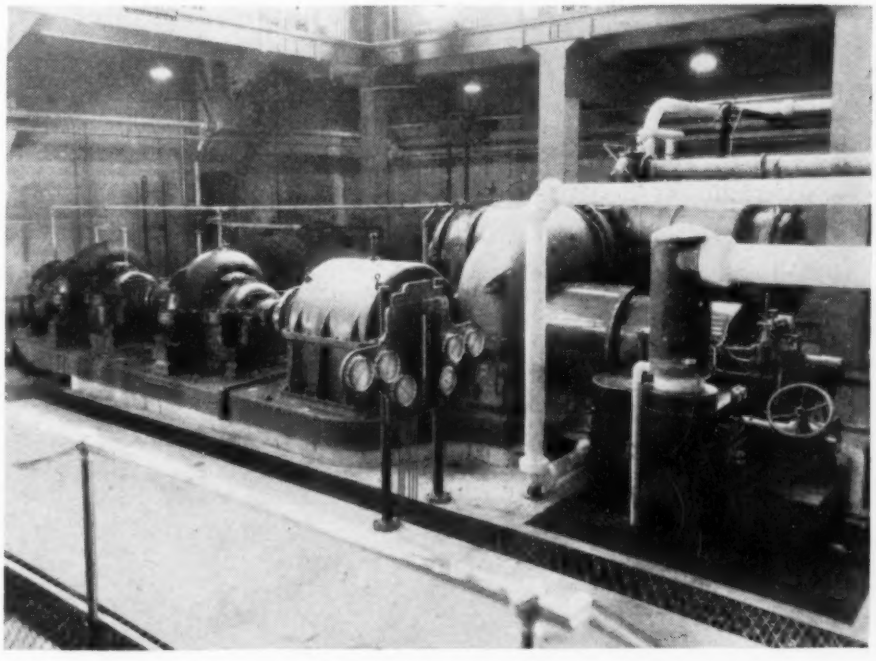
Completely Metered System

All water service except that for automatic fire sprinkler service is metered. All meters of the 2 inch size and below are of the positive displacement type, these being for use in homes, factories and commercial buildings in which the water consumption is not of great volume. For apartment buildings, hotels and industrial establishments with high and low flow rates, the compound meter is used, being a combination of the displacement (disc) and velocity types. For automatic sprinkler service an annual charge of $25 is made for each 4 inch connection and $50 for each 6 inch connection with the city water main. This charge includes periodic inspection of valves to insure their operation in case of fire. All water meters are furnished and maintained at the expense of the property owner.



Steeple Compound Pumping Engine
Installed in 1882 was the only one of its kind ever built.

Water rates for metered service are 6c per 100 cubic feet or 8c a thousand gallons, within the city limits. Outside the limits, water is charged at 9c per 100 cubic feet or 12c per 1,000 gallons. There is a service charge of $2 per annum for meter reading. Adjoining municipalities pay special contract rates approved by the Wisconsin Public Service Commission. The record of the water department shows that 73 per cent of the water users pay less than $10 per annum and less than 2 per cent pay more than $100 per year for water service. There are ten cities, villages and towns that purchase water service under contract.



Milwaukee's Newest
60 MGD. Geared Turbine Driven Series Centrifugals by Allis-Chalmers

Illinois Water Works Operators Prepare for Licensing

Through the Illinois Water Works Operators' Association, the work of preparing for possible future licensing has been under way for some time. Sectional and annual operation meetings are held each year through the cooperation of the State Dept. of Public Health without dues, assessments or registration fees, and a special short course is given yearly at the University of Illinois.

Professional ability in the water works field is recognized by the issuance of Certificates of Competency, granted after application and favorable action by a committee composed of a University of Illinois professor, three prominent Illinois Water Works operators and the Chief Sanitary Engineer of Illinois. To date 24 Class AA, 63 Class A, 169 Class B, and 86 Class C certificates have been issued.

LARGE WATER MAIN CONSTRUCTION BY CITY OF CHICAGO SUPPLIES WESTERN SUBURBS

By W. W. DE BERARD
City Engineer
CHICAGO, ILL.

THE City of Chicago's Water Pipe Extension Division constructed during the Spring and Summer of 1945 an important 36-inch feeder main westward for the purpose of furnishing water to Maywood, a village of approximately 30,000 people. This community lies immediately south of Melrose Park, a village having a population of 10,000, which began taking its water supply from the Chicago system in 1942 when the erection and operation of the Buick airplane engine plant adjacent to Melrose Park made it advisable for that municipality to request supply from Chicago to insure a more adequate and reliable supply than could be expected from its wells.

The Author

A 36-inch main laid in 1942 extends to Harlem Avenue, the western boundary of Chicago. A 30-inch concrete pipe, also laid in 1942, extends from Harlem Avenue west and south to Melrose Park, whence a 24-inch main extends westward 6,000 feet to the Melrose Park reservoir and pumping station.

The studies made and the plan adopted by the Chicago engineers for furnishing these supplies to Melrose Park and Maywood are interesting in that they show the steps taken to solve the problem of a city like Chicago when called upon to supply large suburban consumers without curtailing the supply or pressure within its own limits. The description of the procedure followed is given herewith.

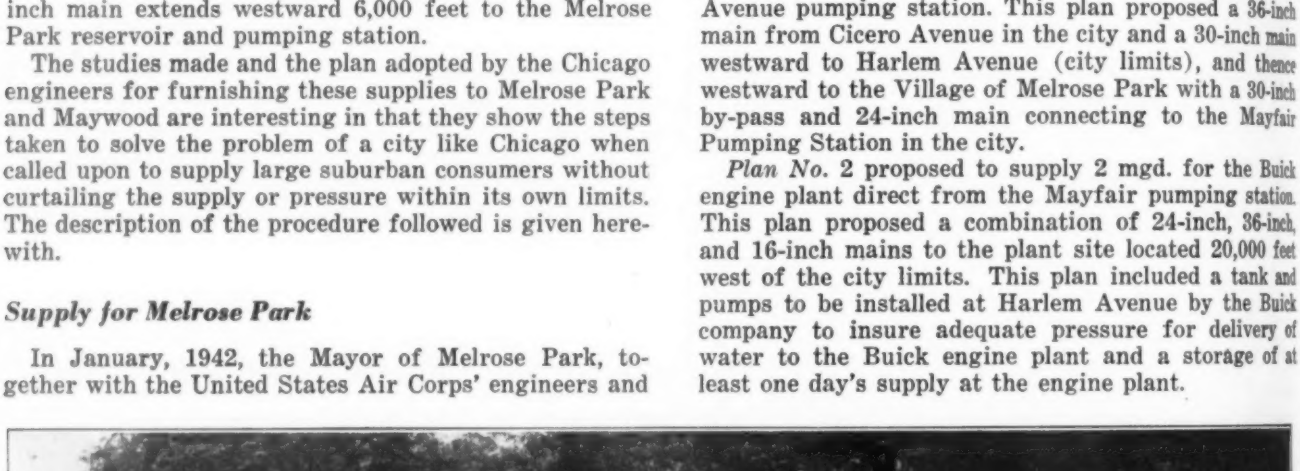
Supply for Melrose Park

In January, 1942, the Mayor of Melrose Park, together with the United States Air Corps' engineers and attorneys, called upon the Commissioner of Public Works of the City of Chicago in connection with the matter of obtaining an adequate and reliable water supply for the village and the proposed Buick engine plant to be located in the village for which the village could not furnish sufficient water from its wells. The Commissioner of Public Works of Chicago offered to furnish a supply at the city limits, new mains to be installed for carrying the water to both the village and the engine plant.

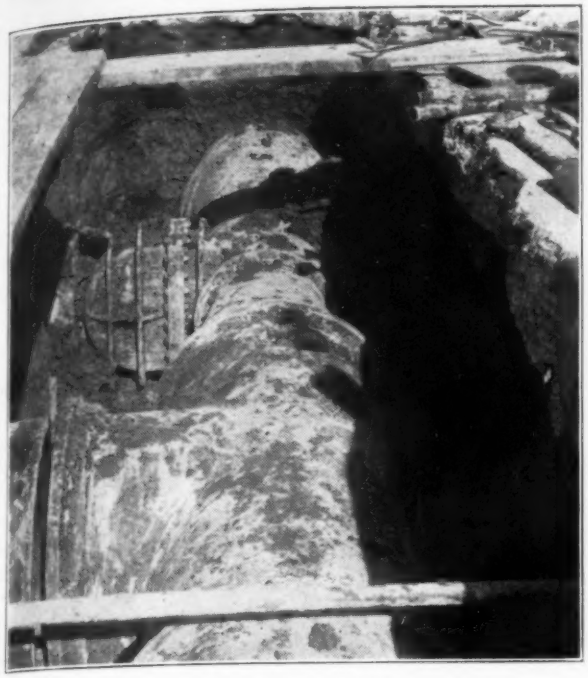
Preparatory to the drawing up of the contract for supply to the Village of Melrose Park and the Buick engine plant in 1942, four plans involving proposed feeder mains were prepared and studied.

Plan No. 1 pertained to a supply of water for the Village of Melrose Park, Buick engine plant and the Village of Maywood to be delivered from the Springfield Avenue pumping station. This plan proposed a 36-inch main from Cicero Avenue in the city and a 30-inch main westward to Harlem Avenue (city limits), and thence westward to the Village of Melrose Park with a 30-inch by-pass and 24-inch main connecting to the Mayfair Pumping Station in the city.

Plan No. 2 proposed to supply 2 mgd. for the Buick engine plant direct from the Mayfair pumping station. This plan proposed a combination of 24-inch, 36-inch, and 16-inch mains to the plant site located 20,000 feet west of the city limits. This plan included a tank and pumps to be installed at Harlem Avenue by the Buick company to insure adequate pressure for delivery of water to the Buick engine plant and a storage of at least one day's supply at the engine plant.



36-inch Water Main Strung Along Proposed Line on Opposite Side of Street in Advance of Work.



36 x 36-inch Connection and 24-inch Valve.

Plan No. 3 was the same as Plan No. 2, except that one of the mains was to be 16-inch instead of 36-inch. In this proposal the Buick engine plant would deal with the City of Chicago direct and always be on a separate service, water to be taken from the Mayfair pumping station. Villages west of the city limits would have to obtain water by way of separate mains from Springfield Avenue pumping station.

Plan No. 4 was for a water supply limited by contract to 3 mgd. for the Village of Melrose Park to enable that village to supply water to the Buick engine plant, the water to be pumped from the Mayfair pumping station. This plan proposed a combination of a 24-inch main and a 36-inch main to Harlem Avenue, to convey water to the Chicago city limits.

It was finally determined that Plan No. 4 should be adopted. The Village of Melrose Park then adopted the plan to lay a 30-inch main from Chicago's city limits at Harlem Avenue westward to the village and a 24-inch main from that point to its reservoir.

Consideration was given at the time to probable required future supplies for Maywood and other western communities to ultimately supply 11 mgd. to the Villages of Melrose Park and Maywood and other consumers within the Sanitary District adjacent to the above named villages, the ultimate 11 mgd. to be taken from the Central Tunnel Zone and pumped from the Springfield Avenue pumping station through additional feeder mains to the western suburbs.

It may be mentioned here that the law passed by the State Legislature in 1889 for establishment and operation of the Sanitary District of Chicago, which district comprises the City of Chicago and a number of other communities lying adjacent to or near the city's boundaries, requires that the city deliver a supply of water at its limits for any community in the Sanitary District which requests such a supply and provides a main to the city limits to take the water from the Chicago mains. The water supplies to Melrose Park and Maywood were furnished by the City of Chicago in accordance with the provisions of the Sanitary District Act.

A contract for a supply of water of 3 mgd. was entered into between the City of Chicago and the Village of Melrose Park for a period of ten years. This contract specified that 3 mgd. be furnished, with 2 mgd. for the Village of Melrose Park and 1 mgd. for the Buick engine plant for the period of the national emergency, and that the supply was to be reduced to 2 mgd. at the end of the war.

The City of Chicago laid 2,050 feet of 24-inch pipe and 2,000 feet of 36-inch pipe to Harlem Avenue city limits. These mains were completed early in June, 1942, and the Melrose Park 30-inch and 24-inch pipe lines were completed in May, 1943.

Maywood Supply

The supply to Melrose Park and the Buick engine plant proved ample to satisfy the demand, but by 1944 the national defense effort had expanded to take in plants in Maywood, adjacent to Melrose Park. The Maywood well supply was inadequate and the village petitioned the city to furnish a supply from its system in an amount of 2 mgd. The City Council in October, 1944, authorized a contract with the Village of Maywood under which Maywood was to take its supply through the Melrose Park 30-inch line running from the city limits by means of a 20-inch main to two Maywood storage reservoirs.

The engineers of the city then determined that the additional requirement for Maywood would necessitate the laying of an additional 36-inch pipe within the city, which would make it possible to take the supply from Springfield Avenue pumping station. Accordingly, the 36-inch cast iron water main was installed by the city. Construction began on April 9, 1945, and was completed on August 7. Two weeks were required for necessary static tests and chlorination of the main, after which, on August 22, it was placed in service.

36-inch Water Main Laid in Trench.

36-inch Water Main Laid Under 48-inch Gas Main, Using Bends.

Difficulties in Obtaining Pipe

Some difficulty was experienced in arranging for a satisfactory schedule of shipments of pipe from the foundry of the manufacturer and a delay in starting the shipments made it necessary for the city to use a small amount of pipe other than the type ordered so that construction of the pipe lines could be started on the date set. Then, after deliveries on the street of the pipe ordered had begun and construction was well under way, it was feared the work would have to be stopped when the city was informed that a United States Government order for pipe for the Philippines would interrupt the filling of Chicago's order in the foundry for a period of two weeks. This delay in manufacture of the pipe, however, did not affect the schedule for construction of the main as sufficient pipe had been received to tide the gangs over the short period of time during which no pipe was delivered.

There were 14,954 feet of 36-inch water main laid in the building of this line, and seven 24-inch valves, five fire hydrants, five blowoff tees and five fire cisterns were installed. The pipe used is known as monocast centrifugal pipe and each piece is 16 feet long with a wall thickness of 94/100 inch and an outside diameter of 38-3/10 inches corresponding to the outside diameter of standard Class "B" cast iron pipe. Certain sections of the main are unlined and have an inside diameter of 36-7/16 inches. One section is cement lined, the lining being 3/16 of an inch thick and the inside diameter 36-1/16 inches. The pipe at one point is Class "B" cast iron pipe with an inside diameter of 36 inches, it having been installed prior to delivery of monocast centrifugal pipe.

Prior to construction of the new main, Melrose Park, Maywood and River Forest, with a combined population of 50,000, were supplied through the feeder mains from the Mayfair pumping station, taking an average of 6 mgd. and a maximum of approximately 8 mgd., with a resultant critical lowering of pressures in one high level area within the city of Chicago. The supply to Melrose Park, Maywood and River Forest was transferred on August 22, 1945, from the Mayfair pumping station to the Springfield Avenue Pumping station, through the new main, thereby increasing the normal pressures in the high level area within the city by about seven pounds. Furthermore, as the new main works in parallel with another 36-inch main in the city, its operation has reduced friction losses and brought about an increase of two pounds in the normal pressures in a low level area in that territory. No change in the operating pressures was necessary at either Mayfair or Springfield Avenue station.

The Federal Works Agency made a grant to the City of Chicago of 40 per cent of the cost of this water main installation.

East Orange Water Department Reports Its Accomplishments

A record of the accomplishments of the East Orange, New Jersey Water Department from 1924 to 1946 is set forth in a 24-page bulletin recently issued by the Board of Water Commissioners of that village.

East Orange is one of the few water utilities that has a forestation program for its water shed, and as may be expected the bulletin contains several pictures of the properties and logging operations. A model of long range planning on a pay-as-you-go basis, the East Orange water utility has a water rate among the lowest in the nation, but one that yields a profit, pays capital improvements out of income, and surplus to the city.

In addition to a non-political board, the chief reason for the success of this utility is the Water Engineer and General Manager, Roswell M. Roper, who has literally grown up with the trees in his 36 years with the department.

In the 22 years since "the East Orange Water Department, owned by and operated in the interest of the citizens of East Orange, was placed on a sound and business basis, the same as a successful public utility" many results have been achieved. Of the 21 achievements listed, these are noteworthy:

Bonded indebtedness reduced $1,479,000; forestry program to conserve water supply, to grow lumber and to prevent erosion, has produced nearly 2 million trees and is returning a profit of some $5000 a year; free use of water meters; construction of boy scout camp and golf course, lifting $462,000 relief load from the city by employing 300 idle men during the depression; selling cord wood worth about $2000 a year; general extension and improvement of water system including mains, reservoirs, hydrants, etc.

This bulletin is a credit to the city of East Orange, its water commissioners and its Water Engineer. It is a model of good public relations as well as good management. If copies are available they should be required reading for other water department managers.

PENNA. WATER WORKS OPERATORS RETURN TO STATE COLLEGE

The Water Tower of State College

FOR its nineteenth annual conference, the Penna. Water Works Operators' Assn. returned to Penna. State at State College, Penna., on Aug. 26 after an absence of five years. Two hundred and twenty-five members and guests (not including the ladies) were obviously happy to be back again at this popular location after the war enforced absence.

There was fun for everyone: baseball games, golf tournament, bridge and bingo for the ladies, evening entertainers and entertainment, free suppers, cards, music, Mr. I. Q. and his silver dollars, door prizes for every session, and in addition seven major papers with discussors.

Welcomed by E. L. Keller, Executive Assistant in Central Extension of the Pennsylvania State College, and Dean Hammond of the School of Engineering, the sessions got under way on the night of Monday, August 26. The General Electric Co. motion picture, "Clean Streams," was shown at one evening session, and Roy G. Howells, the humorous astrologer of Miami, Fla., and Atlantic City, kept the audience howling at another. Prime targets for astrological analysis were Harry Krum of Allentown, "Bernie" Bush (State Dept. of Health), Wilkes-Barre, and Mrs. John (Connie Glace) Roberts of Harrisburg.

There were five golf prizes and five door prizes at each session and four baseball prizes. To list all the winners would require the tabulation of nearly 13 per cent of the registrants.

The first and third sessions were presided over by R. B. Adams, Wilkinsburg, Pres.; the second by T. G. Braman, Washington, 2nd Vice Pres., and the fourth by T. H. Kain, Columbia, Pres.-elect.

Business Session

Not the least interesting session was the business meeting at which the following officers were elected:

President
T. H. Kain, Gen. Mgr.
Columbia Water Co.
Columbia, Penna.

First Vice President
T. G. Braman, Manager
Citizens Water Co.
Washington, Penna.

Second Vice President
Chas. P. Abraham, Supt.
Bureau of Water
Lancaster, Penna.

Secretary-Treasurer
I. M. Glace
Consulting Engineer
Harrisburg, Penna.

In addition to the selection of the new slate of officers, the assembled members heard a report from the Secretary-Treasurer to the effect that the treasury had a $3,000 surplus in it and membership was continuing to grow.

Mr. I.Q.

In a clever takeoff on the Dr. I. Q. radio program, I. M. "Mike" Glace as Mr. I. Q. gave silver dollars for answers to his questions by members of the audience picked by his asstants, E. A. (Nuchar) Sigworth and John (Filter) Roberts. "Mike," who is said to have introduced the "Information Please Quiz" to the water and sewage works field, had as much fun as the audience in tripping up the experts with simple questions.

John Goodell, chemist at Lancaster, was able to spell only four out of five common algae. George Williams, Supt. of Honesdale Water Supply, correctly "guessed" that the horizontal reach of a fire hose discharge at 40 psi. is 60 ft. and that the water from a fire hose will reach higher in the air than it will horizontally.

Robert E. Greene, Engineer, Kendall Refining Co., didn't know that the end hardness sought in most municipal water softening plants is 35 to 80 ppm., and Col. John Miller of Kappe Associates didn't know that the face to face distance of an 8 in. flange valve is 21 inches.

Charles Fox, Ch. Engr., Penna. Water Co., Wilkinsburg, incorrectly stated the principal value of a balancing reservoir (to maintain pressure), and H. M. Olson of the Ohio Salt Co. "believed" the reason for caulking lead joints was to make them tight.

Vern B. Corle, Mgr., West Moreland Water Co., had no idea that there are 1,200 water sheds that have been reforested, but Leon S. (Ducky) Duckworth, wearing a red deer hunting hat, not only knew that a kilowatt is greater than a horsepower, but he knew that 1 hp. is on 0.7456 kw.

C. F. (Dutch) Wertz, of Day and Zimmerman, Inc., Miami, Fla., knew and told all about the effective size of sand, while Harry Krum could and did correctly spell the name of his dog, "Hugo," although he could not spell desiccator, Kjeldahl flask and other common items in his laboratory, and Ted Kain, Gen. Mgr., Columbia (Penna.) Water Co., correctly guessed that the jet velocity from a Palmer filter washer is between 30 and 60 miles per hour, depending, of course, on pressure.

Four other unfortunates failed to collect a silver dollar; their names and the questions muffed were: John Johnson, Supt. of Water, Easton (weight of a hub end ell is 140 lb.); Louis Shepperd, State Dept. of Health (typhoid death rate in 1900 was 35.9 per 100,000); Richard Hayden, chemist, Oakmont Water Authority (24 in. per min. rise of

Presidents

(Incoming)
Ted H. Kain
Genl. Mgr.
Columbia Wtr. Co.
Columbia, Pa.

(Retiring)
R. B. Adams
Supt. Purification
Water Authority
Wilkinsburg, Pa.

filter wash water is 0.023 mi. per hour); and S. G. Layland, Engr., Richland Twp. Water Co. (one psi. equals 2.31 ft. of head).

Total Hardness of Water

John J. Shank, Director, Wayne Laboratories, Waynesboro, Penna., took his listeners behind the scenes in a consulting laboratory and showed how total hardness of water is determined by the new foam test. Mr. Shank also let his audience in on the secrets of the total hardness test.

These secrets include such facts as that hardness is purely a measure of soap consuming power, that standard soap solution should not be calibrated solely against calcium chloride solution as it disregards magnesium, that standard soap solutions purchased from different laboratories do not give check results, and that even the calculation of total hardness of calcium and magnesium content is incorrect as it ignores silica, iron, and alumina.

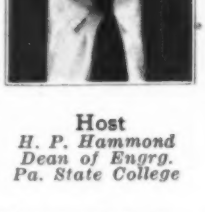
Mr. Shank said that while "Standard Methods" is silent on the many pitfalls of the test and while the procedure is O.K. for routine work but is no good for unknowns, he has nothing better to offer. The Wayne Laboratories has found that for routine work the foam test (Aerotitrator) saves considerable time for the analyst, gives very reproducible results for routine testing, and presents a better technique for differentiating between calcium and magnesium.

While the foam test checks the soap test very well and checks the gravimetric determination better than does the soap test, the foam test is still a standardized technique for determining an empirical result.

High Chlorine Residuals in Distribution System

In a paper authored by **J. O. Fulmer,** City Chemist, and **W. B. Johnson,** Supervisor, Water Dept., and presented by Mr. Fulmer, the Result of Maintaining High Chlorine Residuals in the Distribution System at Easton, Penna., was explained.

Because of the fact that the intake for the Easton water supply is located just below the inside curve of a bend in the Delaware River, it is at the top of one-fourth mile back flow eddy. This pool has become progressively poorer as to quality for a water supply. In 1944 the chlorine demand was two times what it was in 1943 and in 1946 it was three times what it was in 1943. Algae odors were rife. Bacterial counts which were formerly 100 per ml. now reached 500 to 5000 per ml. and 48-hr. gas formers increased markedly.



Host
H. P. Hammond
Dean of Engrg.
Pa. State College

Secy-Treas.
I. M. Glace
Consulting Engr.
Harrisburg, Pa.

To offset this poorer quality supply, coagulation, activated carbon, and chloramination are used. As the water leaves the reservoir it contains 0.2 ppm. of free chlorine, and chlorine as chloramine is maintained at 0.75 to 1.8 ppm. in the extreme ends of the distribution system. By maintaining this high combined available chlorine residual, tastes and odors are reduced and the system is kept free of spore formers and gas formers.

In the discussion of this paper, **L. D. Matter,** Penna. Dept. of Health, said that as long as gas formers were obtained, so too were tastes and odors. Using 50 lb. of chlorine per mil. gal. and a ratio of 10 parts of chlorine to one part of ammonia, there were available 2 ppm. of residual chlorine going into the reservoir, which has a 48 hour storage. Water leaving the reservoir and reaching the distribution system with 1.5 ppm. of residual chlorine has no taste. Obviously, when the intake can be moved to a better location, a better supply will be available with less chlorination.

Vice-Presidents

Tom G. Braman
Manager
Citizens' Water Co.
Washington, Pa.

Chas. P. Abraham
Supt.
Bureau of Water
Lancaster, Pa.

Taste and Odor Control

In "A Comprehensive Survey of the Taste and Odor Control Problem," **Harry N. Lendall,** Chairman, Dept. of Civil Engineering and Professor of Sanitary Engineering, Rutgers University, New Brunswick, N. J., gave the audience a resume of the current attitude toward this subject. In spite of the conflicting statements that have appeared in the literature in the past several years, certain fundamental concepts stand out. One of these is that taste and odor are two of the yardsticks most used by the consumer in his evaluation of a water supply.

Causes of tastes and odors may be grouped into three classes—the aromatic odors of vegetable matter and algae, the phenolic odors of industrial wastes, and the chemical odors of dissolved gases.

Prior to 1931 there was little idea of what to do about tastes and odors; the AWWA manual of 1925 said simply to use an algacide, aerate, and

State College Campus Scenes
The old armory, groups between sessions, and one of the fraternity houses.

Roy H. Ritter
Cons. Engineer
Baltimore, Md.
and
Richard C. Beckett
Chief Engr.
Del. Dept. Health
Dover, Del.

Frank C. Roe
Eastern Mgr.
Chicago Pump Co.
New York
and
"Pat" O'Donnel
Prof. Emeritus
Pa. State College

Myron G. Mansfield
Cons. Engineer
Pittsburgh, Pa.
and
Harry J. Krum
City Chemist
Allentown, Pa.

H. N. Herr
Engr. of Utilities
Hershey Estates
Hershey, Pa.
and
John T. Campbell
Cons. Engineer
Pittsburgh, Pa.

Wm. D. Marshall
Distr. Sales Mgr.
Mathieson Alk. Wks.
Philadelphia
and
Hal S. Hutton
Sales Manager
W. & T. Co.
Newark, N. J.

use chlorine. Since that time there have been many improvements in these old methods, and in addition there has been developed the Threshhold Odor Test which has made possible some evaluation of the amount of these taste and odor producing substances, at least insofar as they are observed by the consumer.

Tastes and Odors may be either prevented by means of algae control, or abatement of industrial pollution, or they may be eliminated from water supplies by removal practices.

In the matter of prevention, the use of copper sulfate as an algacide is still the most popular and most effective method of controlling these organisms in the stream, reservoir, or lake. Copper sulfate may be sprayed on the surface of the water either as a solution or by the newer technic of spraying sized particles of the salt. Efforts should be made to keep the concentration of algae below 500 units per ml.

In reservoirs, a chlorine blanket maintained in the upper strata of the water has been found effective, as has a "blackout" blanket of activated carbon, which, by preventing penetration of the water by light, retards the growth of the organisms. Where chlorine is used for treating a water supply, it has been found that the addition of ammonia to combine with the chlorine "ties up" the chlorine and prevents its reaction with organic matter present, thereby preventing the formation of chlor-phenol tastes.

In the removal of taste and odor compounds once they have been produced in the supply, the operator has several means at his disposal. These include aeration, super-chlorination, activated carbon, "break-point" chlorination, and chlorine dioxide treatment.

Aeration. Ordinary aeration will remove dissolved gases and impart oxygen to the water, but it will not remove phenolic odors and may be assured of removing only 10 per cent of algal induced odors. High pressure aeration is a different treatment; at one installation industrial odors are removed by aeration at pressure of 55 psi. At 110 psi., 98 per cent reduction has been obtained in waters where the threshold odor is 6,000.

Programmers

John H. Murdoch
Chief Counsel
Am. W. Wks. & Elec.
New York

Marsden C. Smith
Chief Engr.
Pub. Utilities Dept.
Richmond, Va.

Super-chlorination. Prof. Lendall defined super-chlorination as (a) chlorination in dosages in excess of the amount required to kill bacteria, and/or (b) chlorination with dosages high enough to require dechlorination. Dechlors used have included sulfur dioxide, sodium sulfite, and activated carbon. Dosages of chlorine up to three parts per million have been successful in some instances but the treatment does not seem to work in oily or swampy water. (Ed. Note: This term super-chlorination, long a confusing one in the field of water treatment, is no longer proper in accordance with the new chlorination terminology which recognizes but two kinds of chlorination—i.e., Combined Residual Chlorination and Free Residual Chlorination. Under this terminology what was once called super-chlorination may generally be expected to be free residual chlorination, unless it is used with ammonia, in which case the treatment would be called chloramination.)

Activated Carbon. Activated carbon as a deodorizer was first used in 1930 in Milford, N. J., and by 1933 400 plants were using the process. Ten years later 1,200 plants were employing this method for removal of tastes and odors. Activated carbon which works by the process of adsorption may be applied either to the raw water or to the water going onto the filters, or it may be applied as a split treatment. The amount of carbon needed varies with the odor being adsorbed, but adequate dispersion of the material is vitally important. In each plant the operator must determine the tolerated threshhold odor and then ascertain the amount of activated carbon necessary to obtain that result.

Break-point Chlorination. According to Prof. Lendall, break-point chlorination is merely "super-chlorination," but according to the new chlorination terminology, so-called break-point chlorination is "free residual chlorination." (Ed. Note: Henceforth, the word "break-point" will mean the chlorine dosage in ppm. at which the residual chlorine

Golf Tournament and Soft-Ball Match
(Foursome in center—Glace, Wertz, Krum and Kappe.)

reaches a minimum after it has once been produced in the water.)

The actual break-point will depend on the ammonia nitrogen content of the water, the pH, and the temperature. This method of chlorination is controlled by the residual chlorine flash test or the ortho-tolidine arsenite test.

Chlorine Dioxide. Chlorine dioxide produced by the action of chlorine on sodium chlorite is both a strong oxidizing agent and strong bactericide. Prof. Lendall said that its future as a treatment process was still subject to further experimentation and study, but so far it had proved very effective in several installations in the country.

In addition to the above, Prof. Lendall mentioned ozonization, permanganate, and adsorbent clays as treatments that had been tried but are not in general use. All water purification processes help in the removal of tastes and odors. Poorest of these for this purpose is coagulation, but long sedimentation will prove helpful. Filtration will ordinarily remove approximately 50 per cent of the odor. Good housekeeping in a water plant is essential to minimize tastes and odors, and it is safe to say that no one treatment is a panacea for all taste and odor problems. Before the final solution to the problem can be had, it will be necessary to know more about the chemistry of the taste producing compounds. Then we "may look for a safer, good tasting water that does not smell."

In the prepared discussions of this paper four persons presented comments with particular reference to the use of chlorine dioxide. **E. C. Goehring,** Asst. Mgr., Municipal Authority, Beaver Falls, Penna., said that results with chlorine dioxide at his plant had been inconclusive.

The paper by **J. C. De Groot,** Manager, Municipal Authority, Northampton, Penna., explained that tastes and odors were a problem in the spring and summer and efforts in the past had been made to control the algae growths by the use of copper sulfate, chlorine and ammonia, and activated carbon. Using one ppm. of sodium chlorite and increasing the pre-chlorination dose to one ppm. produced a better tasting water and at the same time made it possible to eliminate the use of ammonia, activated carbon, and copper sulfate.

Programmers

J. O. Fullmer, City Chemist, Easton, Pa. — *John J. Miller, Kappe & Assoc., Washington,* — *H. N. Lendall, Prof. San. Engrg. Rutgers Univ., NewBrunswick,N.J.* — *Geo. Williams, Manager, Honesdale (Pa.) Water Co.* — *W. B. Johnson, Supervisor Water Dept. Easton, Pa.*

At Columbia, Penna., where there are persistent but not severe fishy and woody odors, and sporadic phenolic odors in the water supply taken from the Susquehanna River, the chlorine dioxide treatment was tried with somewhat unusual results, according to **T. H. Kain,** Gen. Mgr., Columbia Water Co. When chlorine dioxide was added to the clear well the pre-chlorination dosage was stepped up sharply and activated carbon was discontinued. The result was red water caused by the precipitation of iron and manganese. When the chlorine dioxide was added in the middle of the sedimentation basin, the iron and manganese which was thrown down plugged the filters and increased the amount of wash water required. A third method of dosage was to split the addition of the chlorine dioxide between the raw water and the final basin.

It required up to 10 ppm. of chlorine in the raw water to remove the iron, but this did not touch the manganese, so half the chlorine dioxide dosage was added in the raw water to remove the manganese, and the rest was added in the clear well. Disinfection has been excellent, the count and coliform content has been zero; color, manganese and iron have been entirely removed. Phenols have been reduced from 1700 to 200 ppb. Some activated carbon is still added directly onto the filters, but there is still a slight taste.

At Royersford, Penna., **B. F. Reitnour,** Supt. of Home Water Co., uses chlorine dioxide intermittently to handle severe tastes and odors occurring in his supply, which is taken from the polluted Schuylkill River. When chlorine dioxide was first tried, with rather high pre-chlorination, sloughing occurred in the mains and a chlorinous taste developed. The treatment caused the precipitation of iron and manganese and while the treatment is used at times, Mr. Reitnour is reserving judgment on the process.

War Time Water Supplies in Germany

Lt. Col. J. John Miller, Corps of Engineers, and now a representative of Kappe Associates, Washington, D. C., told the story of how water supplies were maintained in bombed Germany after the American troops moved in. Among the interesting features of the talk were the references to the system of organization of the water command, types of water supplies "inherited," industrial waste pollution, the Hopp system of tunneling for ground water, and artificial ground water supplies produced by variations of the infiltration gallery method.

Eats and What Followed

(Snapped during one of the two sumptuous buffet suppers served in one of the fraternity houses and a quiet game after the repast.)

Public Utility Practices

Lynn B. Curry, Chief of Utility Engineers, Bureau of Rates and Research, Public Utility Commission, Harrisburg, Penna., reviewed the practices and regulations of the Public Utilities Commission of Pennsylvania as it affects the water utilities. Inasmuch as the P. U. C. has jurisdiction over authorities as well as municipal and chartered local water utilities, the practices of this commission are of particular importance to water works managers and superintendents in Pennsylvania. This relation was obvious in the number and complexity of the questions asked of the speaker during the discussion period.

Water Quality in Distribution Systems

Speaking as the Chairman of the AWWA Committee on Chemical and Biological Problems in Water Distribution Systems, **Marsden C. Smith**, Ch. Engr., Dept. of Public Utilities, Richmond, Va., said he hoped to awaken the interest of water works operators in these problems.

It is hoped that many volunteers will help to gather data by chemical and physical examinations of samples collected from different parts of the distribution system. While not all water systems will prove suitable for study, contribution of such data from various parts of the country will help to solve the problem of "Water Quality Depreciation in Distribution Systems."

Under Mr. Smith, Richmond has developed some successful methods for maintaining the quality of water after it leaves the treatment plant. Inasmuch as the depreciation of water quality in mains appears due to chemical reactions and the products of living organisms, first efforts were directed toward preventing either of these.

To reduce organic matter entering the distribution system, all effort is expended to make the water clean before it leaves the plant. Super-prechlorination and super-coagulation is practiced. Enough chlorine is added to the raw water to make dechlorination necessary after 14 hours in a settling basin. "Double coagulation" as practiced means employing alum in summer and iron in the winter for best results, and some waters both are used.

pH is adjusted when necessary, and mechanical flocculation by special mechanical equipment is considered essential. For a final "scouring" the water receives activated carbon just before it goes on the filter.

Old, dirty mains contribute to depreciation of water quality, and in Richmond, post-chloramination, liming to a phenolphthalien alkalinity, and copper sulfate are used to inhibit biological life in the mains. These treatments are effective.

In the matter of distribution system design to aid in the maintenance of water quality, Mr. Smith believes that the separation of the water from the ferrous material of the pipe, removal of known habitats for bacterial life, and shortening of time from plant to consumer are essential to maintaining water quality in the mains.

The first of these is accomplished by the use of emulsion treated, cement lined, cast iron pipe instead of the conventional tar dipped inner coating. The second is accomplished by the use of mechanically joined pipe, using lead tipped rubber gaskets in place of hemp and jute caulking.

The third necessity is to avoid oversized mains and feeders, thus tending to reduce the opportunity for stagnation. While mains should not be too small to maintain pressure at maximum demand, the theories that "no main can be too large" or that "no pipe should be smaller than 8 inches" are untenable for fringe areas. Service headers in streets not on main lines are recommended in place of larger mains just to serve a few houses.

As a result of these practices at Richmond, no complaints on taste and odor have been received since June, 1945.

Standby Service Needed for Calamities, Including Strikes

Speaking neither as the President of the Pennsylvania Water Works Association, nor as Attorney for the American Water Works and Electric Co. of New York, but as a person with some experience in the day-to-day operation of water utilities, **John H. Murdoch, Jr.**, presented a paper on "The Increased Necessity for Standby Service as Indicated by Fires, Floods, Wars and Strikes."

John F. Laboon
Director
Allegheny Co.
Public Wks. Dept.
Pittsburgh, Pa.

Allan Darby
Sales Engr.
The Dorr Co.
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G. A. Rohlich
Prof. San. Engrg.
Penna. State
College

Myron Mansfield
Cons. Engr.
Morris Knowles
Pittsburgh, Pa.

Fred Ferris
Cons. Engr.
Short Hills, N. J.

F. E. Gerlitz
Asst. Sales Mgr.
Simplex Valve & Meter Co.
Philadelphia, Pa.

Geo. A. Elias
Distr. Engr.
State Dept. Health
Philadelphia, Pa.

"In view of the fact that today a failure of water supply is a catastrophe, no operator should be content with anything less in the way of precautions than those which good engineering economics indicate as advisable."

This certainly applies as to fires, floods and wars, but the possibility of service interruptions in water plants caused by strikes presents an entirely different set of problems not heretofore experienced by water utility operators. Thus there appears to be an increased necessity for means of meeting the possibility of strikes.

With this premise as a starting point, Mr. Murdoch commented on the sense of personal dignity of employees, resentment of favoritism, the human trait of wanting to be a leader or to be associated with a leader, job security, pride in the enterprise, loyalty to a brotherhood or "crusade" to improve conditions, the necessity for union leaders to accomplish further gains or lose their leadership.

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Supt. Purification
McKeesport, Pa.

W. W. Hodge
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Mellon Inst.
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H. A. Worrest
Supt.
Water & Sewage
Millersville, Pa.

C. G. Wertz
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Water Dept.
Miami, Fla.

Hugh Rice
Boro Mgr.
State College, Pa.

Roy H. Ritter
Whitman, Requardt
& Associates
Baltimore, Md.

Chas. L. Fox
Chief Engr.
Penna. Water Co.
Wilkinsburg, Pa.

On the other hand, management representing the owners (either municipal or private) has certain beliefs, among them that an organization cannot function if orders must be debated with the employee or his representative, subject to majority vote, that wages to labor which penalize "wages" to the owners are unfair and not good management.

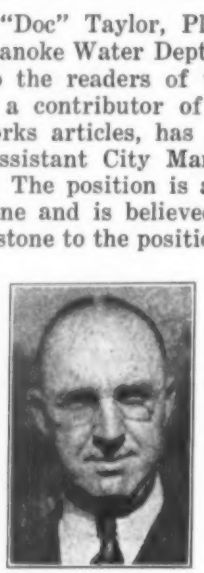
Mr. Murdoch believes that management and labor can meet on a common ground but that both must "get their houses in order." Management's foremen must be carefully chosen, employees must be advanced on the basis of merit, wages must be fair, etc. Unions, on the other hand, have a responsibility to themselves and to the public and must shoulder those responsibilities.

Mr. Murdoch closed with the following statement:

"I think that a strike in public service is an unmitigated social evil which should not be tolerated in a civilized community. I think it should not be tolerated and will not be tolerated. Further, I believe that no such strike is necessary with public opinion available to force a fair settlement of all disputed points. Public opinion is the best standby service as a safeguard against strikes." (G. E. S.)

"Doc" Taylor Made Asst. City Manager by Roanoke

D. R. "Doc" Taylor, Plant Supt. of the Roanoke Water Dept. and well known to the readers of this magazine as a contributor of practical water works articles, has just been named Assistant City Manager for Roanoke. The position is a recently created one and is believed to be a stepping stone to the position of City Manager upon retirement of the present City Manager, W. P. Hunter, who has held this post for a number of years. The appointment represents a marked advancement and recognition of the career services of another excellent water works man. The appointment is effective November 1, 1946.



D. R. Taylor

For the past twenty years with the exception of service with the U. S. Engineers during World War II, "Doc" Taylor has been connected with the Roanoke Water Works, formerly the Roanoke Water Co. A native of Lynchburg, Va., he attended public schools there and was graduated with the degree of B.S. in Mechanical Engineering in 1919 by the Va. Polytechnic Institute (Ye Ed's Alma Mater also).

During his recently completed war service he distinguished himself in the supervision of water and sewage utilities and was discharged a major. He served as editor-in-chief of a group selected to prepare manuals of operation and maintenance of water and sewage works systems in army posts. Since his return to Roanoke he was named chairman of the Board of Trustees charged with administration of the pension system recently installed for city employes.

Active in association and civic affairs, "Doc" (nicknamed so because of his initials, D. R.), Taylor is a past president of the Lions Club and the Roanoke Country Club; a member of the Am. Soc. of Civil Engrs.; past chairman of the Va. Section of the Am. Water Works Assn.; member of the Federation of Sewage Wks. Assns., and is a licensed professional engineer in Virginia. He has been a prolific writer of technical articles and a leader in the water works profession in Virginia.

It is our belief that Charlie Moore, Gen. Manager of the Roanoke Water Dept., will feel the loss of his Plant Superintendent keenly, but "Doc" Taylor's host of admirers will consider his elevation a happy and well deserved recognition of career service, leadership and ability.

Fifteenth Annual Georgia Water & Sewage School

The Georgia Water and Sewage School was held for the fifteenth time under the joint auspices of the Georgia Water and Sewage Assn., the Georgia School of Technology, and the Georgia Department of Public Health on Sept. 16-18 at the Chemistry Building of Georgia Tech.

In addition to the technical papers and examinations for Class B and C Water and Sewage Certification, a water meter repair school was conducted daily at the Atlanta Water Works Meter Shop.

The technical program included papers on Chlorination, Taste and Odor Control, Plant Maintenance, Chemistry of Water and Sewage Treatment, Public Relations, Infiltration in Sewers, Geology of Ground Water, and Swimming Pool Operation.

Round Table Discussions were held on Water Distribution and Sewage. In the former such topics as Records, Main Sterilization, Sample Collection, Corrosion, and Cross Connections were discussed. The latter included Safety, Scum Control, Sludge Digestion, Industrial Waste, and Imhoff Tank Operation.

The General Electric Co. motion picture on "Clean Waters" was shown and inspection trips were made to two water plants and one sewage plant. Thirty-two persons participated in the program. Secretary of the Assn. is Van P. Enloe, Supt. of Sewage Treatment, Atlanta.

IMPROVING WATER PLANT OPERATION WITH ACTIVATED SILICA

Part II—Upflow Units

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THE widespread adoption of upflow water treating units has been an outstanding development in recent years. These plants have many features which justify their consideration for any water clarification problem. Nothing about these newer designs, however, makes it less important to give careful study to the chemical characteristics of the water supply in order to have most efficient operation.

In *Water & Sewage Works* for September, 1946, it was pointed out in Part I of this article that the use of an activated silica sol, as a coagulant aid, can generally improve operation of conventional horizontal-flow plants. Some minor revisions were shown to be necessary to obtain maximum benefits. Since the purpose of the coagulant aid is to correct a deficiency in the chemical balance of the water, it is to be expected that its use will likewise prove advantageous in many upflow plants.

This paper is not concerned with the design of upflow units, but it is, of course, equally as important as in the case of conventional plants, to provide for adequate chemical mixing which in some cases may include provision for reversing the order of addition of chemicals. Also the advantages of large-sized filter media and high rates of filtration would be the same for either upflow or horizontal designs. These points have been covered in Part I of this article.

This discussion will be limited to several instances where the operation of upflow units was strikingly improved by establishing a proper chemical balance in the water with the use of activated silica sols. No further mention will be made of the numerous upflow installations which are performing with full success with the usual coagulants, the use of which is generally known. Experience gained in upflow equipment confirms the findings in plants of conventional design to the effect that activated silica can improve the clarification of the great majority of water supplies. Its adoption would depend on whether or not the advantages exist in adequate degree as was plainly evident in most of the cases to be described.

The Author

Importance of Proper Chemical Treatment

The principle on which all upflow designs are based is one of maintaining a suspended floc. Through this "sludge-blanket" or from the surface of the "slurry pool" the clear water is released. It then rises to an overflow weir. For many industrial purposes, the water from the unit may be delivered directly to the clear well without filtration.

It has not been a simple matter in the past to develop consistently the best type of floc for the most efficient operation of any of the various water plant designs. If coagulation is difficult, a small light floc is obtained which does not settle out adequately in conventional plants and therefore passes to the filters. In an upflow unit such floc does not permit a sharp line of demarcation between the body of suspended sludge and the clarified water. The light floc rises with the water and passes over the weir. In spite of mechanical control features, this loss of floc has continued, in a few cases, until the concentration of suspended sludge was too low for normal efficiency.

When an extremely light-floc exists, units operating at high rates may develop "boils." Unequal distribution of the vertical rise of the water or non-uniform flow rates cause such localized disturbances. These sludge boils may be eliminated by the use of mechanical corrections, a lower flow, or a heavier floc. Operation may also be upset by too rapid change in the rate of flow. The seriousness of such fluctuations will depend on their magnitude and the weight of the floc.

Upflow units are equipped with sludge removing devices; nevertheless, it is sometimes necessary to shut the units down for cleaning or repair. This results in complete loss of the suspended floc upon which efficient operation depends. Return to normal operation will be delayed until the proper sludge concentration has been obtained.

The best type of floc for any water clarification equipment is one that is fast-forming, large, tough and heavy. Previously, large flocs were usually light and weak while fast-forming flocs all too frequently failed to produce sparkling water. One other floc characteristic would be highly desirable in plants of upflow design. If the floc density and quality could be varied, there would be an additional control to supplement mechanical features of coagulation. A light floc could be made heavier, and one too heavy to permit the maintenance of the required level of sludge suspension could be made lighter. It now appears that such "tailor-made" flocs are readily obtainable in most waters.

Mention of floc difficulties with upflow operation carries with it an obligation to point out that the engineering principles are not being criticized and that even where such troubles are occasionally encountered the advantages of this type of equipment have justified its use. Several cases are known to the writer in which users of upflow equipment have re-ordered identical units to meet increased demand even before finding that the use of activated silica could solve coagulation problems arising from failure to achieve the optimum chemical balance for most efficient operation of the equipment.

Capacity Increase

The final measure of proper chemical balance for clarifying water in any given piece of equipment is the volume of high quality water which can be produced. Good quality water often may be obtained at low flows without the optimum chemical balance. This deficiency in chemical adjustment, however, will not permit the same quality of high rates and in no case can the best quality be produced except at the proper chemical balance.

An outstanding improvement in upflow operation by proper chemical treatment was reported by R. E. Noreus[1] of the Northwest Paper Co. at Cloquet, Minn. Instead of installing a complete upflow unit, this company utilized an already existing square basin and placed in it the mechanism normally intended for a circular upflow unit. When trial runs were made it was found to be impossible to produce the expected 3,500 gpm. rate with an alum floc. The maximum water output of satisfactory quality was 2,000 gpm. Experiments with pH adjustments, alkalinity changes, floc weighting with clay, and studies with various coagulants failed to produce optimum coagulation. The use of an activated silica sol proved to be the answer. Noreus gives the results of using the N-Sol-A process, developed by the Philadelphia Quartz Co., as follows: "The effect of activated silica is to produce a heavy, large, fast-settling floc which leaves 6 to 7 feet of clear water above the sludge bed at any rate up to 4,000 gallons per minute. . . . When the silica treatment is discontinued, the rate must be dropped to 2,000 or lower or the sludge will not settle fast enough."

Near Charleston, W. Va., a standard upflow unit rated at 1,200 gpm. was never operated in excess of 900 gpm. without deterioration in water quality. The alum dosage was 12 ppm. and a small amount of sulfuric acid was being added to further drop the pH. The addition of 4 ppm. of activated silica produced optimum coagulation and immediately improved clarification in both the upflow unit and a parallel conventional flocculation and sedimentation plant. Longer filter runs were obtained in both plants. The same improvement in water quality was maintained when the chemical dosage was changed to 8 ppm. of alum and 2.4 ppm. of silica even when the rate in the upflow unit was increased to 1,200 gpm. When a rate of 1,550 gpm. was tried with the reduced chemical dosage the water quality was poorer, returning to the condition obtained with 12 ppm. of alum at 900 gpm. It was concluded that for an additional cost of $1.20 per million gallons it would be possible to obtain the high quality water with alum and silica at the 1,550 gpm. rate. The ultimate decision, however, was to operate at rated capacity of 1,200 gpm. using the lower alum and silica dosage which costs only a few cents more per million gallons than previous operation with alum at 900 gpm. Additional upflow units have been added to meet an increased water demand.

In Pennsylvania, an upflow unit treating an unusually difficult industrial trade waste could not operate above 50-60 per cent of rated capacity because alum did not produce proper coagulation. The adoption of the N-Sol-A process so improved flocculation that the plant was operated at 90-95 per cent of rating during summer months. Although this degree of efficiency was not maintained throughout the past winter, it was found that proper coagulation could not be obtained at the lower water temperatures unless activated silica was used. With some minor alterations in chemical dosage and equipment, it is expected that rated capacity can be maintained through the year even on this waste.

In a California industrial waste treating plant (not of upflow design) the use of silica made possible the clarification of a salt brine containing 6,000-9,000 ppm. chlorides. Activated silica is also used in an East Coast industrial upflow plant, clarifying sea water for regenerating a zeolite softener. In these cases the weight of the alum-silica floc permitted operation at rates greater than otherwise would have been possible with the high density salt waters.

Color Removal and Cold Water Clarification

Two things that contribute to a light, weak, alum floc are the presence of organic color and a low temperature. Difficulties with cold water clarification will be treated in detail in Part III of this series. Organic coloring matter, as is pointed out by Camp,[2] tends to reduce floc densities. Alum floc densities may drop as low as 1.002. It is imperative to correct this condition if color removal and clarification is to be obtained at high rates of flow.

Noreus[1] showed that with a water of 150-400 ppm. color he was able to get 90 per cent color removal with alum at 57 per cent of rated capacity, whereas he obtained 95 per cent removal from alum and silica with flows of 114 per cent of rating. He stated also that by increasing the silica dosage he could obtain nearly as good settling of floc during winter months as he could in the summer.

The color encountered by Noreus is typical of the northern evergreen woods. It is of interest to note that activated silica is also used in conjunction with color removal in upflow units drawing water from the Louisiana bayous, the Florida Everglades, and the New Jersey lowlands. Elsewhere, with conventionally designed plants, it has similarly been shown that color removal and floc settling is improved by the alum-silica floc. With raw water colors of 80-100, alkalinities of 47-53 ppm., and a pH of 6.9-7.1, it has been possible to get 94 per cent color reduction at 34° F. with 110 ppm. of alum and 5 ppm. of silica. Only 88 per cent removal resulted from the same alum dosage alone. If the better color reduction is not important, lower alum dosages may be used. To obtain these results it is essential to add the silica with rapid mixing after the alum has formed a partial floc. In many cases not involving color removal the silica is added ahead of the alum.

Turbidity Removal

Very little experience has been obtained by the writer on the treatment of highly turbid waters in upflow equipment. A case in which the clarification of Delaware River water having a turbidity of 150 ppm. was improved by the addition of small amounts of silica after the alum floc had partially formed will be described later in this paper. The advantages of using silica for the treatment of waters of much higher turbidity in conventional plants have been established by Schworm[3] at St. Louis, where softening is practiced, and more recently by Rumsey[4] at Kansas City, Kan., where alum clarification is used.

In a Texas upflow unit, clarifying a very difficult type of turbidity, 153 ppm. of alum gave only fair results. The high acidity developed by this treatment necessitated heavy soda ash correction. With activated silica it was possible to drop the alum dosage to 51 ppm. The soda ash was proportionately reduced. In subsequent tests it was found possible to provide a satisfactory water by the use of sulfuric acid and alum. This latter method is now employed. Additional tests with silica are planned.

Upflow Softening

One of the difficulties encountered in the clarication of lime softened water with alum is due to the formation of a fine granular or crystalline precipitate when organic matter is present in raw water. This is particularly true if the waters are low in magnesium content or if the removal of calcium only is involved. This type of precipitate has considerable weight, but it apparently has insufficient volume for the best operation in upflow equipment. It was found that the substitution of activated silica for alum as a coagulant gave a very different kind of floc.

Describing the Florida lime-softening operations, Dr. A. P. Black, Consulting Engineer and Professor of Sanitary Engineering at the University of Florida, stated[5]: "Ten plants in the area have already substituted silica for all or part of the alum, with results which have been uniformly excellent. The flocs formed are large and 'leathery,' turbidities of settled water have been greatly reduced and filter runs have been increased in practically every instance and in some cases have been more than doubled." Four of these plants are of upflow design. Continuous service records now exceed three years.

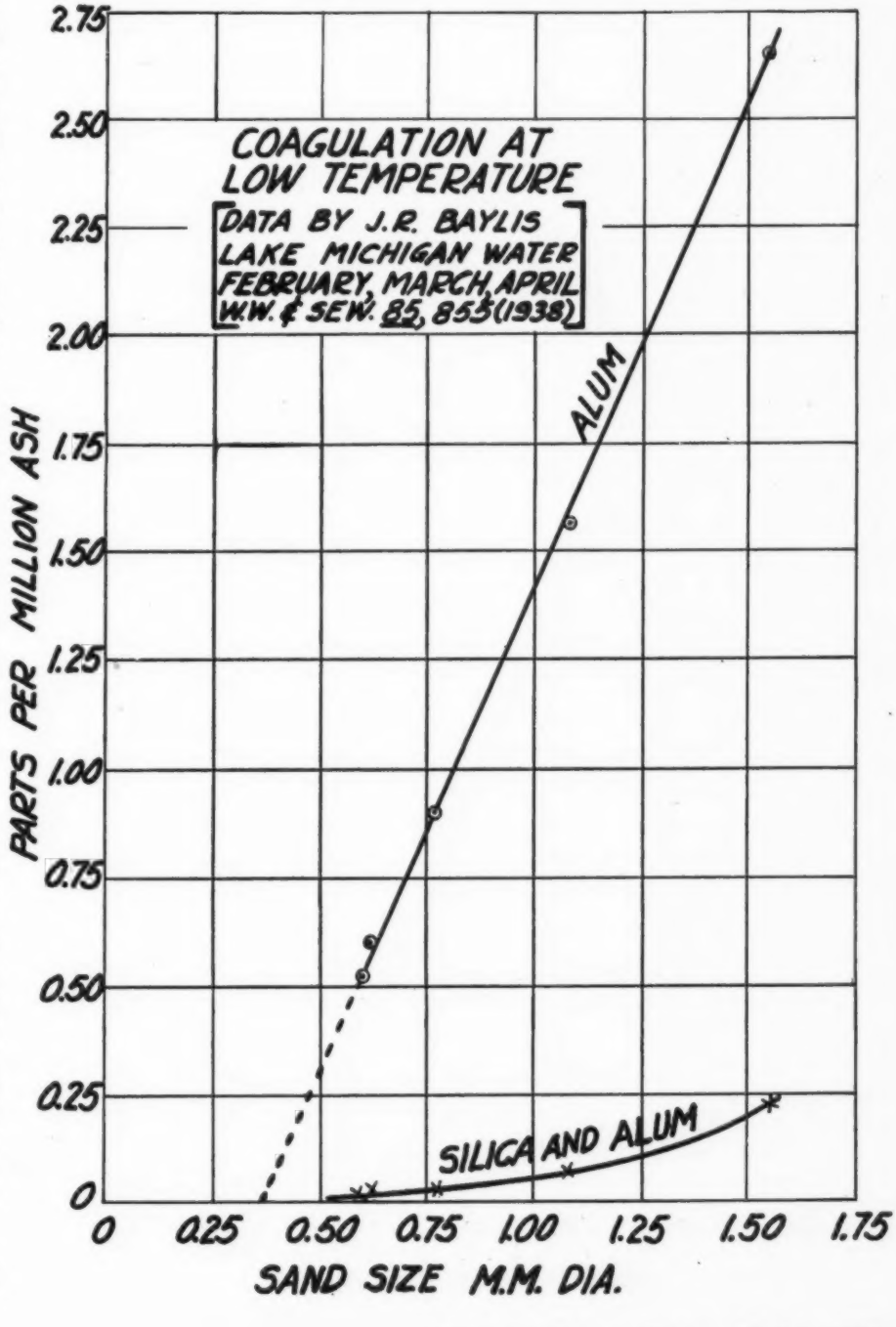
Studies on activated silica in the lime softening of high magnesium waters are not sufficiently complete to permit detailed discussion. In one pilot plant upflow study it has been found that the light magnesium hydroxide floc, formed almost in the absence of calcium carbonate, gave trouble which was not corrected by the use of alum as a coagulant. Activated silica, however, established a denser floc which permitted the unit to form the desired sludge concentration and resume normal operation.

"Tailor-made" Floc

In the past there has been a natural reluctance to design for high rate of flow, without realization that the real reason for occasional operating difficulties was the result of inability to create the necessary conditions for proper functioning with the usual coagulant. The weakness of the floc during cold weather, or during difficult raw water conditions, was taken along with the weather as being a correlated phenomenon about which little could be done. It has now been shown that varying the silica dosage can offset the low temperature effect.

It is now possible to change the floc to fit the weather if this should be desirable. At an upflow plant in northern New Jersey, a low alkalinity, low turbidity, colored water was treated with full satisfaction using alum and soda ash during the summer months. In winter, however, the alum floc was not sufficiently heavy and was too fragile. For a period of months this unit did not have adequate suspended sludge concentration to permit good operation. When the soda ash was dropped and activated silica used, the unit was operating at full efficiency within twenty-four hours. After several days of excellent operation, the use of silica was discontinued. Within a few hours the suspended floc lightened in weight and passed onto the filters. It was not possible to reestablish efficient operation until the feeding of silica was resumed.

Another manner in which floc of variable weight can be used to good advantage was indicated in an upflow unit operating on Delaware River water at Camden, N. J. This plant was meeting the demand at one-half of its rating and was producing an effluent of satisfactory quality. The desired level of suspended solids was maintained with a motor setting of 4.0 on a scale having a maximum setting of 9.0. If the speed were increased to 6.5, the excessive velocity imparted to the water (excessive for this particular floc weight) caused boils of turbidity which greatly decreased the effluent quality. When 5 ppm. of activated silica were added,



the floc immediately increased in weight to such an extent that, at the 6.5 scale setting, insufficient agitation and circulation were being provided. Even at the maximum setting of 9.0 the circulation did not carry the slurry pool above the optimum elevation for good operation.

In the preceding example it can be seen that possibly the optimum degree of floc improvement should not have been used. Too heavy a floc was produced. A lower silica dosage might have shown a better over-all advantage at the low flow. Then, as greater water demand developed, the silica dosage could be raised and floc density increased. As a result of this experiment it is evident that through the use of silica this plant will be able to operate at or above full rate capacity when the occasion arises. The additional flow of water will suspend the floc and will permit lower motor settings, thus re-establishing this control mechanism.

An even more important feature of "tailor-made" floc is its value in starting up a unit that has been cleaned. It has been stated earlier that these plants do not operate efficiently when the necessary concentration of suspended solids is not present. With the heavy silica-alum floc, however, there is less floc lost during the period when the suspended solids concentration is being built up. Because the silica-alum floc is not as sensitive to pH changes and produces optimum coagulation over a wide range, it is possible to double both the alum and silica feeds during the initial period of operation. In this manner the sludge concentration was increased one per cent per hour. (Percentage was determined as volume settling during 5 minutes in a 100 ml. sample contained in a calibrated graduate.) At the end of seven hours the desired concentration of 7 per cent was reached. The unit then operated efficiently, the chemical dosages were reduced to normal, and sludge draw-off was started. Usually, throughout the history of this unit, it had required seven days to reach the same concentration attained in as many hours with the silica method. This result has been confirmed elsewhere on two other water supplies.

The procedure just mentioned is of particular value in the operation of upflow units. Increased feeding of coagulant and soda ash or lime have previously been used, but it is now found that the heavier alum-silica floc gives quicker and more certain results. During regular operation it is also possible to remedy promptly any effects of excessive sludge removal.

Cost and Water Quality

Just as in the operation of conventional plants, the chemical costs resulting from the adoption of activated silica will vary with each water supply and the efficiency of previous practice. The treatment at one upflow clarification and color removal plant in Louisiana was changed to include silica and the costs dropped from $39.84 to $19.86 per million gallons. At the same location the shift to activated silica in a parallel conventional flocculating and settling basin showed almost identical reduction in treating costs.

Savings accrue from several sources such as the use of a less expensive coagulant or lower coagulant dosage, the elimination of soda ash or lime as a pH correcting agent (usually, but not always, possible), lower wash water consumption, soap savings due to elimination of alum in softening or elimination of lime for pH correction of soft waters, and decreased fixed charges when plant operation at a higher rate of flow is made possible. (This latter factor was considered in Part I.) Lower chemical costs with activated silica have been discussed by a number of authors as indicated in an earlier publication[6] and also as reported by Black.[5]

For some waters an increased chemical cost may be expected. Noreus[1] justifies a higher cost as follows: "While use of silica slightly increases the water treatment costs, the reduction in wash water and improvement in water quality are sufficient to offset it." Another advantage which he pointed out was that the use of silica doubled the output of the treating unit. In some cases it is not possible to justify the use of activated silica with present equipment and treating rates.

Water quality is always improved wherever activated silica is used to establish the proper chemical balance. The production of a more sparkling water has been repeatedly confirmed. Baylis[7] first emphasized this in his article on "Effect of Silicate Treatment on Quality of Water," which appeared in *Water Works and Sewerage*. From the time of his earliest work, however, there were some who were not satisfied that the activated silica would be completely removed with the floc. Baylis[8] stated, "Our tests . . . indicate no increase in the silica content of the water." Noreus[1] showed that when a raw water containing 17.5 ppm. silica was treated with alum and 5-12 ppm. of activated silica, the filtered water contained only 8.5 ppm. of silica. This indication that activated silica will actually reduce the raw water silica content has just been confirmed by Klinger of Consolidated Water Power and Paper Co.,[9] who, in plant scale practice in Wisconsin, showed that activated silica and alum reduced the silica content of the finished water 23-32 per cent below that of the raw water clarified with alum alone.

Conclusions

The previously reported values of activated silica coagulant aids for improving operation of conventional water treating plants have been confirmed in a number of upflow units. Correct chemical balance achieved with silica has permitted some units to operate at rates 25 per cent in excess of rated capacity while maintaining excellent water quality. Specific advantages from the use of activated silica in upflow units operating at or above rated capacity are the rapidity with which high sludge concentrations may be reached, the ease with which the desired sludge may be maintained and the low turbidity of the effluent. To date activated silica has been applied only to meet the most difficult coagulation problems. More general acceptance seems assured but will depend upon individual considerations of economy and the need for water of higher quality.

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STATE COLLEGE HOST ALSO TO PENNA. SEW. WKS. ASSN.

The Famed Lion of Nittany Mountain

IMMEDIATELY following the Penna. Water Works Operators' Assn. Meeting at State College, the Penna. Sewage Works Assn. moved in to meet for two days. Many persons, members of both associations, stayed over to swell the total attendance at the sewage works meeting to nearly two hundred.

No golf tournament lured the devotees of pitch and putt, but many foursomes teed off in friendly competition, and the more athletically inclined indulged in a softball game.

For entertainment there was **Dr. J. O. Perrine,** Asst. Vice Pres., Amer. Tel. and Tel. Co., New York, who gave an enlightening discourse "Concerning Things Electrical" aided by rocks that talked, molecules that marched, and a gadget that measured the blush of a pretty girl.

There were also songs led by **Dave Evans,** Sanitation Equipment & Chemicals, Reading; stories by **Senator J. A. Esquirol,** Southhold, L. I.; the inimitable introductions by **H. E. (Ted) Moses as Toastmaster,** and the movie "Clean Waters."

Business Session

In reporting the year's work, **Bernard S. Bush,** Secy.-Treas., gave the then present membership at 253 with several additional applicants at this meeting. This growth of nearly twenty-five new members in the past year reverses the trend downward during the last year of the war.

The meeting amended its constitution to conform to the Federation pattern and adopted several resolutions, among them, one of sorrow for the passing of A. S. Bedell, longtime Secy. of the NYSSWA and second president of the Federation.

Officers elected for the ensuing year were as follows:

President:
Wm. J. Murdoch
Cons. Engr.
Pittsburgh, Penna.

First Vice Pres.:
Norman G. Young
Borough Manager
Phoenixville, Penna.

Second Vice Pres.:
Chas. H. Young
Dist. Engr.
State Health Dept.
Meadville, Penna.

Director:
L. D. Matter
District Engr.
State Health Dept.
Harrisburg, Penna.

Editor:
J. R. Hoffert
Asst. Engr.
State Health Dept.
Harrisburg, Penna.

Secretary-Treasurer:
Bernard S. Bush
District Engr.
State Health Dept.
Wilkes-Barre, Penna.

Stream Pollution

In commenting on "Pennsylvania's Program for Stream Pollution," **H. E. Moses,** Chief Engineer, Pennsylvania Dept. of Health, said that the program had been under way for two years. With 100,000 miles of streams, and 1000 communities in six drainage areas covering 45,000 sq. mi., the magnitude of the program can be seen.

Mr. Moses reviewed the history of the Pennsylvania Department of Health and its efforts to clean up the waters of the state. In 1944 a state-wide program was undertaken, with control of stream pollution for the entire state "predicated on the principle that all sewage and industrial waste must be treated to at least a primary degree."

After hearings were held, the Sanitary Water Board sent notices to municipalities and to industries, requesting that plans be prepared for treatment. Five hundred thirty-one municipalities and institutions and 494 industries have received notices. Of these, 239 municipalities have retained the services of engineers, and the Allegheny County Sanitary Authority has been formed to handle the pollution problems of 126 communities in the Pittsburgh area.

Not included in the above totals are notices issued to anthracite coal operators requiring the adoption of measures to prevent discharge of coal mine silt into streams, etc. Some 152 applications have been received from collieries for approval of treatment works, and several have been built. With the accomplishment of this aim, the dredging of coal from streams will cease to be profitable. In connection with this program 30,000,000 cu. yds. of silt are to be removed from the Schuylkill River.

Monies have been appropriated by the State to be granted to municipalities and corporations (in limited cases); $4,250,000 is available for preparation of plans; $500,000 for mine sealing; $1,750,000 for acid mine water diversion and silt control; and $175,000 for research.

Mr. Moses closed with a plea for cooperation and a statement that "Pennsylvania had set an example for the entire nation and its program is being watched with great interest."

Financing Sewage Works

There are five ways in which Pennsylvania local governments may finance sewage works, according to **Dr. Harold F. Alderfer,** Director, Bureau of Municipal Affairs, Harrisburg, Penna. These are (1) by current income and capital reserves, (2) by special assessments, (3) by incurring indebtedness, (4) by the creation of an authority, and

Presidents

(Incoming)
Wm. J. Murdoch
Consulting
Sanitary Engr.
Pittsburgh, Pa.

(Retiring)
*L. D. Matter**
Distr. Engr.
State Dept. Health
Harrisburg, Pa.

*(*Director-elect, Sewage Wks. Federation Board of Control)*

(5) by granting a franchise to a private corporation.

Few municipalities have capital reserves and perhaps there are not many more that are not already up to the millage limit. The law is not clear as to special assessments for treatment plants, but this method is good for sewers.

Indebtedness may be incurred in temporary or bonded manner, and the bonds may be of non-debt revenue or general obligation type. Creation of municipal authorities to construct and operate sewage treatment plants is an excellent idea for joint economic or drainage basin areas.

Franchises given to private corporations to construct and operate sewage works are not generally popular but there are fourteen of this type in Pennsylvania.

Dr. Alderfer discussed the Mansfield Bill provisions for grants-in-aid and loans as well as other provisions, and asked the question: "Do Pennsylvania municipalities need outside aid for municipal treatment works?" Probably not, if the works are financed by non-debt revenue (sewer rental) bonds, but with construction costs skyrocketing, it is difficult to say at the present time.

Dr. Alderfer was emphatic on one point, that State aid should not go just to municipalities cited to abate pollution, but should go to all municipalities within the state.

In discussing Dr. Alderfer's paper, **C. W. Tillinghast**, Director, Southeastern Division Pennsylvania Economy League, Inc., Harrisburg, said that in his opinion, current monies should be used for treatment works financing insofar as possible in order to keep down the bonded indebtedness. Furthermore, Mr. Tillinghast believes that while special assessments can be used for sewage treatment plants, the revenue bond is the best idea. As to municipal authorities, these are merely means for removing by one step, the functions of representative government, but the idea is sound for joint community action.

Federal Aid

On the matter of "Federal Aid in the Advance Planning of Public Works," **Wm. J. Finley**, the Penna. Representative of the Federal

Secy-Treas.
Bernard S. Bush
District Engr.
State Dept. Health
Wilkes-Barre, Pa.

Director
*Francis S. Friel**
Albright & Friel
Engineers
Philadelphia, Pa.

*(*Vice-Pres. Sewage Works Federation)*

Works Agency, Bureau of Community Facilities, stated flatly that "Congress won't enact Federal aid unless we need it," but the granting of aid for advance planning is to avoid peaks and valleys in construction. The F. W. A. has allotted more than four million dollars to Penna. and to date some three million plus has been used by municipalities in the State.

Mr. Finley explained Title V of the War Mobilization and Reconversion Act and its provisions for the loans for advance planning. Also explained was the Bureau of Community Facilities administration policies and how to make application for funds.

Vice-Presidents

Norman G. Young
Borough
Manager
Phoenixville, Pa.

Chas. H. Young
Distr. Engr.
State Dept. Health
Meadville, Pa.

Operation of Army Sewage Works

Both **Rolf Eliassen**, Prof., Sanitary Engineering, New York University, and former Lt. Col., U. S. Army Engineers, and **Col. W. A. Hardenbergh**, Editor, *Public Works Magazine*, and former Director of the Sanitary Corps, spoke strongly on the need for the creation of a Sanitary Corps of engineers on sanitary and related sciences, and the defeat of proposals to make the sanitary engineer corps a mere part of the medical corps.

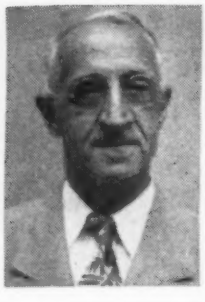
Speaking from experience in the matter of dual responsibility on sanitary engineering matters between the Sanitary Corps and the Corps of Engineers, Prof. Eliassen said, "In most instances this dual responsibility of the Corps of Engineers and the Medical Department was resolved satisfactorily, mostly through the individual cooperation of the sanitary engineers of each branch of service. However, there were a number of circumstances in which difficulties were encountered through this divided responsibility. This was particularly true when certain medical men were trying to interpret principles of sanitary engineering with which they were not familiar. For greatest overall efficiency, this division of responsibility should not overlap to such a great extent but should be more sharply defined.

"It is desirable that the Army take cognizance of this situation and resolve responsibilities into definite categories in order that sanitary engineers may present a strong and

Groups Between Sessions

(Center—Ed. Wagner, Boro Engr. of Downingtown, Pa., and "Rod" Coltart, Sales Engr. for Link-Belt Co.)

Robt. J. Schatz
San. Engr.
Pa. State College



Harry J. Krum
City Chemist
Allentown, Pa.

G. A. Hall
Asst. Engr.
State Dept. Health
Columbus, Ohio

Frank C. Roe
Eastern Mgr.
Chicago Pump Co.
New York

M. W. Tatlock
R. L. Woolpert
Engrs.
Dayton, O.

M. B. Tark
Sanitary Engr.
Bureau Sewers
Philadelphia, Pa.

united front in the vast complexity which is the Army. The writer is inclined to believe that sanitary engineers would receive greater recognition, and therefore stronger support from highest headquarters, in the accomplishment of their objectives in the fields of water supply, sewage treatment and mosquito control, if most of this authority were concentrated in the Corps of Engineers. This corps is composed mostly of trained engineers and already has much of the responsibility for the design and operation of sewage treatment plants, as well as complete responsibility for their construction. Effective liaison must be maintained with the Medical Department but most of the sanitary engineering officers should be in the Corps of Engineers rather than in the Sanitary Corps of the Medical Department as they were during the past war."

Col. Hardenbergh, in commenting on this vague division and responsibility for sanitary engineering between the Sanitary Corps and the Corps of Engineers, said, "War times are not peace times, and there should be a clear-cut responsibility for specific sanitary engineering duties in the post-war army. This will permit training and planning as a part of the necessary peacetime functions. A distinct sanitary engineering organization, with specific responsibility, adequate authority and reasonable freedom of action, is absolutely necessary. Personnel must be limited to qualified men; engineering leadership is essential; position vacancies and provision for technical supervision throughout the chain of command must be established. If these minimum requirements are not met, we will have a second or third rate engineering organization, which is worse than having none at all.

"The present plan of the Medical Department for post-war sanitary engineering is particularly unsound and vicious—not intentionally so, but because it is based on a total lack of understanding of the problem. It practically precludes the possibility of an effective sanitary engineering program; it does not provide for nor recognize the necessity for any organization, leadership or formulation of engineering policies. This plan is based on the provision of a non-technical Medical Service Corps into which the engineers will be integrated. Bills covering this will be introduced into the next Congress. I hope that every one of you will urge your Senators and Congressmen to defeat these bills or to so modify them as to provide for a sound and effective sanitary engineering program."

In addition, Prof. Eliassen briefed the highlights of his paper, discussing such items as types of sewage treatment plants at Army Posts, supervision of operation, operating results, and preventive maintenance, "one of the Army's outstanding wartime contributions to the field of sewage treatment."

Col. Hardenbergh also commented on design factors, the National Research Council Report on Sewage Treatment, the survey of German waste disposal practice, and the action necessary with respect to Army Post sewage plants when the camps were drastically reduced in population or closed.

Ground Garbage in Sewage Works

The effect of ground garbage on sewer systems and sewage treatment plants has been a topic of discussion for only eleven years, and **S. L. Tolman,** Sanitary Engineering Division, Jeffrey Mfg. Co., Columbus, Ohio, reviewed the record from the first large garbage grinding experiment at Indianapolis to the present proposed dual disposal plants at several cities.

On the subject of home grinders, Mr. Tolman quoted from M. M. Cohn's writings to show that even installation of these devices in every home would increase the flow by only 1.5 per cent, and that the suspended solids load would be increased approximately 50 per cent. At a normal expected rate of installation, the increased load will not be appreciable for some years to come. No difficulties or stoppages of sewers have been observed where home grinders are used.

Central grinding stations are another story. If they are installed, the

J. R. Harvey
Asst. Engr.
State Dept. Health
Philadelphia, Pa.
and
Chas. H. Young
Distr. Engr.
State Dept. Health
Meadville, Pa.

W. B. Hart
Engineer
Atlantic Refn'g Co.
Philadelphia, Pa.
and
Roy F. Weston
Sanitary Engr.
Atlantic Refn'g Co.
Philadelphia, Pa.

Howard Gilligan
Operator, Boro
Treatment Plant
and
*William Bubb**
Operator
The College Plant
State College, Pa.

**Seventeen years of service)*

Alfred Estrada
Design Engr.
and
Gordon Wiest
Chemist
Albright & Friel
Engineers
Philadelphia, Pa.

Stanley Kappe
and
John Miller
Kappe & Associates
(Mfr's. Agents)
Washington, D. C.

Programmers

Rolf Eliassen
Professor
Sanitary Engrng.
N. Y. Univ.
N. Y. City

Sam L. Tolman
Sanitary Engr.
Jeffery Mfg. Co.
Columbus, Ohio

H. E. Moses
Chief Engr.
State Dept. Health
Harrisburg, Pa.

Gladys Swope
Chief Chemist
San. Authority
Allegheny County

R. N. Simpson
Gilbert Assoc.
Engineers
Reading, Pa.

Ben H. Barton
Supt.
Treatment Works
Findlay, O.

R. S. Rankin
Div. Manager
The Dorr Co.
New York

flow of sewage increases less than 1 per cent, but the suspended solids load on the treatment plant increases by perhaps 50 per cent at once. No difficulties are observed by sewer stoppages; grit, of course, can be and should be removed before discharging the ground garbage to the sewers.

If the garbage is ground at the sewage treatment plant, provision for grit removal should be made, either by adding the ground garbage ahead of the grit channel, or if the garbage is added directly to digesters, by a special pit or similar arrangement.

To indicate the strength of sewage containing ground garbage, Mr. Tolman presented a table in which calculations had been made based on 0.5 lb. of green garbage per capita, and various per cent solids content from 17.5 to 30. The suspended solids in the mixed sewage and garbage will be from 32 to 55 per cent higher than in sewage alone. The B.O.D. will be increased by 22 to 38 per cent.

Mr. Tolman included in his presentation a review of the effect of garbage grinding on primary treatment at Indianapolis and Findlay, Ohio, and on digestion tank operation at Marion, Ohio, Goshen, N. Y., and Lansing, Mich. The effect of ground garbage on activated sludge plant operation was also commented on.

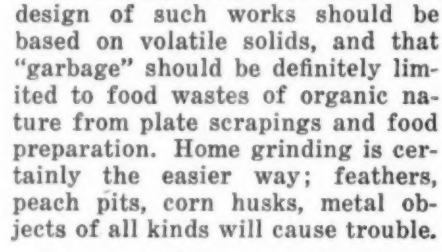
In concluding, Mr. Tolman said, "To be ultra-conservative, we can say that garbage suspended solids and B.O.D. are removed as readily as are similar constituents in raw sewage" in a primary treatment process, and the B.O.D. load of garbage does not retard the oxidizing ability of activated sludge.

At least 5 cu. ft. of digester capacity per capita should be provided for garbage and primary solids; if secondary sludge is digested, 9 cu. ft. should be provided. The most economical means of dual disposal appears to be by direct addition of garbage to the digesters, and the cost of disposal at the sewage plant will be between $0.10 and $0.50 per ton.

In discussing Mr. Tolman's paper, **Ben H. Barton,** Chief Operator, Sewage Treatment Plant, Findlay, Ohio, said, "Digester capacity for dual disposal in a complete treatment plant where garbage is treated with sewage solids should start at ten cubic feet per capita." This opinion is based on actual experience.

Mr. Barton believes also that the design of such works should be based on volatile solids, and that "garbage" should be definitely limited to food wastes of organic nature from plate scrapings and food preparation. Home grinding is certainly the easier way; feathers, peach pits, corn husks, metal objects of all kinds will cause trouble.

As a note of warning, Mr. Barton said that odors arising from the storing of green garbage are a nuisance and four tons of garbage per million gallons (actual concentration during grinding operations) is the saturation load for activated sludge. It also seems desirable to neutralize excess garbage acids with 40 mesh quicklime at the grinder.



Top-Flight Softballers

(From left) J. R. Harvey, J. O. Fulmer, Wm. J. Murdoch, "Honey Sue" Yenchko (Umpire), John Gittins, Paul Rogers (Manager and Catcher), R. W. Kramer, Dave Evans, Jr. (All won prizes for outstanding playing—Manager Rogers and Umpire "Honey Sue" excepted.)

Sewage Operators' Clinic

"Opportunities for the Operator" and "Tips on Operating Problems" were respectively presented by **L. D. Matter,** District Engineer, Penna. Health Dept., Harrisburg, and **R. W. Simpson,** Sanitary Engineer, Gilbert Associates, Inc., Reading. Time did not allow Mr. Matter to expand on his topic, but Mr. Simpson reviewed a number of "tricks," "kinks" and "gadgets" he had employed at Keesler Field, Biloxi, Miss., to improve operation. [A similar paper on the same subject by Mr. Simpson was reviewed in the NYSSWA meeting report in our August issue.]

D.D.T. at Sewage Plants

Mr. Simpson also presented some timely information on the use of D.D.T. around sewage plants. Larvae of the filter fly can be controlled by adding the equivalent of 1 ppm. for a 24 hour flow all at one time and allowing the filter to stand idle for not more than one hour interval before resuming the filter operation. For adult fly control use a 5 per cent spray. Mr. Simpson also explained the various forms and concentrations in which D.D.T. could be obtained, how and where to use each, how to prepare the emulsion, cost of preparation and how to use the material for the control of flies and mosquitoes, as well as the hazards in handling the material.

Status of Industrial Waste Treatment

In presenting a broad survey of the "Present Status of Industrial Waste Treatment," **Almon L. Fales,** partner of Metcalf and Eddy, Engrs., Boston, said that municipalities should make provision to treat such industrial wastes as they can, but that industry should pay its share of the cost. Industry should also treat its own wastes

The Old and The New

These two treatment plants on adjoining properties serve the college and the borough under separate managements. The trickling filter plant on right has served the college many years. The newer plant is a Chicago aerator plant, providing activated sludge treatment for the Borough of State College. So, here is a unique case of competitive treatment of sewage of essentially the same quality.

where municipal treatment works cannot handle them.

Mr. Fales also commented on the pollutional effects of industrial wastes and the characteristics of the wastes as well as the magnitude of the problem and methods for treating wastes.

C. L. Siebert, Cons. Engr., Camp Hill, Penna., discussed Mr. Fales' paper and presented several examples of both successful and unsuccessful attempts to treat canning wastes, paper mill waste and packing house waste.

"Much of the investment in waste treatment is wasted because of poor operation; competent inspection is necessary to good operation," according to Mr. Siebert.

The B.O.D. of Industrial Wastes

While the ordinary operator of a sewage plant has watched the B.O.D. test grow more and more complicated through the years, the determination of the B.O.D. of industrial wastes finds the B.O.D. test to fall far short of ideal, according to **Roy F. Weston,** Sanitary Engineer, The Atlantic Refining Co., Philadelphia.

The complications that arise in the use of this determination on industrial wastes result from such variables as time of incubation, temperature, concentration and state of food supply, chemical characteristics of dilution water, presence of seed and growth factors in the dilution water, microscopic organisms present and their size and age.

Miss Gladys Swope, Chief Chemist, Allegheny County Sanitary Authority, Pittsburgh, emphasized the difficulty of obtaining proper seed in an industrial plant and the necessity that fresh seed be used in order to obtain consistent results. Miss Swope also commented on the composition of dilution water and Mr. Weston's plea for the adoption of a dilution water representing a mean analysis of U. S. surface water supplies [a similar suggestion was proposed by this reporter in 1928].

In view of the fact that the B.O.D. test apparently falls down in industrial waste problems, either requiring far too much controlled technic or giving results that are erratic or doubtful, the audience rose to cry for a new and more simple test. Opinions varied from one that "the B.O.D. test is the 'lousiest' test in Standard Methods," and another that "we are using a rubber yardstick" to one which said that "a test developed to control biological sewage processes should not be applied to strong industrial wastes."

Trickling Filter Performance

Speaking on the above subject, **Dr. Harold A. Thomas, Jr.,** Harvard University, Cambridge, Mass., showed how from the study of Army Post sewage plants he had developed formulas for the determination of the efficiency of trickling filter operation, with and without recirculation in single and two stage filters. For this purpose the load is calculated in pounds per equivalent acre foot, the equivalent acre foot volume taking into consideration the recirculation factor. Dr. Thomas' formulas were as follows:

(a) Load $= \frac{W}{A \times d \times F} = \frac{W}{VF}$

Where W = lb. B.O.D. in settled raw sewage
A = Filter area in acres
d = depth
F = recirculation factor

$$= \frac{1 + R/I}{(1 + 0.1\ R/I^2)}$$

and R/I = recirculation ratio

(b) % Efficiency, (Single Stage)

$$= \frac{100}{1 + 0.0085\sqrt{\frac{W}{VF}}}$$

(c) % Efficiency, (Second Stage)

$$= \frac{100}{1 + \frac{0.0085}{1 - E_1}\sqrt{\frac{W^1}{VF}}}$$

Where 100 E = % Efficiency of first stage
W^1 = lb. B.O.D. in effluent from first stage.

From these formulas, Dr. Thomas had calculated the efficiency of various trickling filter plants under different conditions of operation and showed how the best results may be obtained with balance design.

R. S. Rankin, Mgr., Sanitary Division, The Dorr Co., discussed the paper by Dr. Thomas and praised the efforts made to assemble and correlate the vast amount of data on these trickling filters at military posts, but questioned whether all of the data studied should have been given equal weight in the analysis.

The conclusion that removal of B.O.D. by a filter and following settling tank is a function of applied load, volume of filter and rates of circulation, and that dosing rate is of no significance, may need further study and consideration. Low rate filters without recirculation do not conform to the theoretical curve. Mr. Rankin explored the performance of filters on an area basis and finds an 80 per cent removal curve fits most plants, and concludes that the area basis has not been disproven for predicting B.O.D. removal.

Mr. Rankin commented also on the conclusion that dosing rate has no effect on high rate filters, the need for adequate settling capacity following the filter, the need for the continuous withdrawal of humus sludge, and the need for further study of these unique formulas for evaluating performance, as they may apply to older municipal installations.

Lectures and Class

On left, R. W. Simpson is demonstrating D.D.T. in its several forms. In the center the man closest to camera is A. L. Fales of Boston, a veteran sanitary engineer. On right, E. L. Keller, executive assistant in extension work for Pennsylvania State College, receives a hand for the way in which he handled the meeting arrangements.

Something New in Wash Tanks

The accompanying picture is that of the 50,000 gal. wash-water tank of the Woodlawn Water Co. serving Aliquippa, Pa. The structure is 41 ft. in height to the sphere proper, which provides a head range of 18½ ft.

The softening plant at Aliquippa takes its supply from a well field on the banks of the Ohio River. The raw water has a hardness of 300 ppm. One-third is treated with lime to raise the pH from 7.3 to 9.6, followed by a mixing period of 30 minutes and a 3½ hour period of settling. The partially softened water, with iron and manganese precipitated, is filtered through two sand filters into the so-called hard water well.

Two-thirds of the water is softened to zero hardness by passage through six zeolite beds. The two waters are then mixed to produce a stabilized water of approximately 75 ppm. total hardness and pH of 8.0.

Raw water, after heavy chlorination, is used for filter washing and zeolite bed rinse at an appreciable saving in cost of wash and rinse water, formerly consisting of completely softened water, which practice reduced the plant output by about 300,000 gal. per day.

The 50,000 gal. wash-water "Watersphere" was fabricated and erected by the Chicago Bridge & Iron Co. under supervision of Morris Knowles, Inc., of Pittsburgh, Pa., as consulting engineers to the Woodlawn Water Co.

Ohio Sectional Conferences on Sewage Treatment

Ohio is one state (New York is another and there are a few others) where sectional one-day meetings give the small plant operator an opportunity to participate in meetings devoted to the subject of sewage treatment. Where ofttimes it is impossible for operators of the smaller plants to attend sectional or even state meetings, these sectional conferences bring "technical conventions" to their own front door, so to speak.

Besides the State Sewage Works Association, Ohio has four regional "conferences," which hold meetings at regular intervals. This past summer, thirty Northwestern and twenty-five Northeastern Conference members "assembled in the garage at the Norwalk Sewage Treatment Plant to initiate a 'School for Sewage Treatment Plant Operators' . . . under the tutelage of A. H. Niles as sewage professor, and W. F. Crohen, Port Clinton, in the chair of mathematics. The adopted text was War Dept. Manual TM5-665. . . ." This information is gleaned from a mimeograph report of the conference prepared by its secretary, Ben Barton of Findlay, Ohio.

The report also contained copies of the papers presented, one on "The Biological Filter for Secondary Treatment" by John S. Hess, Asst. Supt., Alliance, and one on "Filters of the Fixed Nozzle Type" by John Wolf, Chairman of the Northeastern group, and summaries of the discussions of the papers.

The policy of these conferences with respect to papers is that the subject matter is devoted to the type of plant in which the meeting is being held.

The following paragraph excerpted from the Transcript of the meeting shows the value of these meetings with respect to public relations: "Inspection of the Norwalk Plant and the beautifully kept grounds was made during the school recess periods. A remark by a member expressed the general opinion of the group viz., 'Ohio should hold a Mayors' Conference at the Norwalk Plant to demonstrate what a successfully operating plant can and should look like.' "

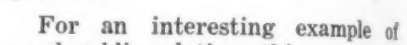
Orlando's 1945 Report

Last year we made quite favorable comment on the 1944 annual report of the Orlando (Fla.) Utilities Commission. The 1945 report, presented in different format, is no less unique in its ability to get across to the reader, by a few simple paragraphs and readily understood graphs and charts, the whole story of operation. One chart labeled "Comparative Trends" shows "whence the money comes and whither it goes." Another shows the creation of a cash reserve for long range plant and property improvement. A third section concisely shows how the Utilities cuts the city taxes in half. A double page spread of pictures shows the Utilities office and "How the Water Plant Ticks."

The Orlando Utilities includes the power plant and the report presents pictures and information on this phase. Obviously, behind the production of this interesting 20-page booklet are pages and pages of statistical data and reports, but these have been neatly summarized on one page. Tabular data are left where they should be—in the files of the persons who need them; for the public only the highlights of interest are presented.

For an interesting example of good public relations this rates with the best and is the result of the work of Martin W. Brown, General Manager.

Could Be!



"Yeah, Joe! The Mayor wants to know if we can't let him have a couple of hollow ones that he can use for water and sewer pipes until Washington realizes that the housing program can't proceed far without water and sewer lines."

COMMUTATOR MAINTENANCE

By C. B. HATHAWAY*
Westinghouse Electric and Manufacturing Co.
EAST PITTSBURGH, PENNA.

COMMUTATOR maintenance of industrial size motors can be made easier when an understanding exists of what goes on in the motor. A commutator, being an assembly of many parts, is only good as long as all of the parts stay in the same mechanical location with respect to each other. If one or two bars move out of place with respect to the others, the commutator becomes rough and sparking will occur when they pass under the brushes.

Construction of Commutators

Practically all commutators used in industrial machinery in sizes above 1 hp. are of the vee type. In such a commutator, a vee-shaped groove is machined in each end of the copper commutator bars and separating mica segments. A corresponding inverted vee is machined at the back end of the commutator bushing and in a separate retaining ring that assembles at the other end of the bars. The bars are clamped between the two vee rings and are insulated from them by a molded mica vee ring.

The machining of the vee ring on the bushing and steel retaining ring must bear a definite relation in radius to the machining of the vee grooves in the bars. Before assembly, the steel vee rings have a slightly smaller diameter than the vee grooves in the bars. When assembled, the pressure applied to the steel retaining vee ring draws down on the inner edge of the vee groove of the commutator bars as indicated by arrows marked "B" in Fig. 1. This reduces the diameter of the assembled segments and thereby places them in arch binding.

It is also important to have the upper edge of the vee groove, as indicated by arrows marked "A" in Fig. 1, make firm contact with the mica vee rings and the commutator steel parts. This provides a seal against the entrance of dirt at the edge of the bars and also puts an outward stress against the tips of the bars. With this initial stress in the ends of the bars they are less likely to be thrown outward due to centrifugal force when the commutator rotates. The ends of the bars will not move until the outward stress due to the centrifugal force exceeds the initial stress in the bars.

The necessary elasticity to compensate for expansion and contraction in the commutator resulting from different temperatures is provided in the mica. The strain placed upon the mica segments in compression must be such that the bars are held firmly together when the commutator is cold and must be within the elastic limit of the mica when the commutator is hot. The rise in temperature of the commutator is, of course, accompanied by the expansion of the copper in all directions. The chief concern is with the expansion that occurs in the bars circumferentially. If the commutator has especially long bars, some provision must be made to absorb the expansion along the length of the bar.

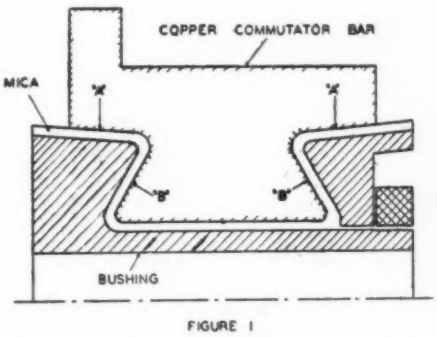


Fig. 1—Cross-section of commutator showing vee type construction.

Both the mica segments and the mica vee rings are made up from flake mica which has a diameter of about 1¼ in. The flakes are held together with shellac. The built-up mica parts are thoroughly pressed and baked before they are assembled with the other parts of the commutator.

All commutators should be seasoned after assembly with new mica parts. The purpose of the seasoning is to drive out all excess shellac at the pressure points. This can be done with one heating and tightening but a much better job results when the operation is repeated several times.

An oven in which commutators are seasoned should be held at a temperature between 160° and 180° C. The temperature of the commutator should not be permitted to exceed 150° C. or slippage of the mica flakes will occur when pressure is applied. These mica flakes will come out above the surface of the bars. There is no danger of annealing the copper which has been cold worked to obtain hardness of these temperatures. Cold worked copper will not anneal until temperatures above 200° C. are encountered.

Commutation—A Maintenance Problem

Commutation is a maintenance problem because of the damage done to the commutator by the brushes. Sparking at the brushes, if at all severe, results in burning the surface of the commutator and causing the brushes to ride poorly. The effect is cumulative and continues until the sparking becomes so bad a flashover may occur, and as a result, the machine must be withdrawn from service and repaired.

The sparks occurring at the brush result when the current is reversed in a coil as the bars, to which its leads are attached, pass under the brush. The time of this reversal is extremely short and therefore high reactance voltages are set up. To overcome the adverse effects of these high voltages, a commutating pole or interpole is frequently used to set up a voltage from the coil in which the current is being reversed to counteract this reactance voltage. If it were possible to completely compensate for this reactance voltage, no sparking would occur at the brushes, providing the commutator is smooth and the brushes ride evenly.

Occasionally every third bar around the commutator shows smut while the two bars in between have a normal color. This can happen where there are three bars per slot. In the case where there are four bars per slot, every fourth bar is sometimes found blackened. This is due to improper strength of the commutating field or improper shape of the face of the commutating pole.

The commutating condition for each of the three conductors in the slot is different. The energy set up by the reversing of the current in coil "A" in Fig. 2 is partially transferred to the coil "B" by mutual inductance. When coil "B" starts its commutation it has a chance of unloading part of its energy to coil

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"C," but when coil "C" is commutated there is no place to deliver its energy; therefore it is more likely to

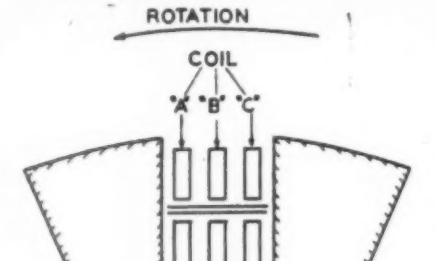

Fig. 2—Cross-section of rotor showing coil arrangement in slot.

deliver it as an impulse through the brushes. This impulse, of course, may show up as a spark or an arc of very short duration.

Since the commutating condition in the three coils is different, the commutating pole design can only be made to take care of the average condition and the inherent energy absorbing capacity of the brushes must be relied upon to take up the difference between the average and the peak values of voltage. If the strength of the interpole is not adjusted for this average, the strength of the peak energy is apt to be greater than can be absorbed by the brush. Obviously, this peak will be excessively strong in only one coil of the group in the slot. Such a condition can be eliminated by correcting the strength of the interpole flux.

Carbon Brushes

An inherent characteristic of carbon brushes that ride upon a moving commutator is the drop of one volt between the face of the brush and the surface of the commutator. This voltage drop varies slightly with current, but for all practical purposes it may be considered as one volt. Some brushes have much higher contact drop than this, while others, such as the copper-graphite brushes, have much lower contact drop, but these will not be considered here as they are used in very special applications. As mentioned before, this one volt drop provides a cushion to absorb the energy set up by the armature coils being commutated—that is, not fully neutralized by the commutating poles.

The density of the current in the brushes does not follow a hard and fast rule. Modern electro-graphitic brushes will operate satisfactorily with densities up to 65 amperes per square inch continuously. However, accepted practice holds this density to between 40 and 50 amperes per square inch. Many cases have arisen where responsibility for poor commutation is blamed on high density and additional brushes have been insisted upon. There is no evidence to support the contention that an increased number of brushes, when applied only for the sake of reducing the current density, has been beneficial. Additional brushes may, however, improve the mechanical contact problem and thereby be beneficial. For example, if a motor has but two brush arms with only one brush per arm, a great improvement can be obtained by adding one or two more brushes per arm (see Fig. 3) because it isn't likely that all the brushes with the same polarity will be off the commutator at the same instant. This does happen, however, in the case of one brush per polarity.

Proper Hardness of Brushes

The question of the proper hardness of brush arises frequently. The softer brushes are more likely to result in better commutation. This is thought to be due to the fact that they wear away more rapidly and present a fresh face to the commutator and therefore maintain a higher contact drop. However, soft brushes have two distinct disadvantages; one is that they wear away more rapidly, and the other is that they are more easily chipped or broken where there is any vibration or pounding present.

It is imperative to use hard brushes on applications where there is any considerable amount of vibration, such as a motor driving a load through spur gears. Gears introduce a high-pitched vibration into the motor armature, which results in chattering of the brushes. Soft brushes will break up under this chattering and are unsatisfactory. The hard brush, however, does not wear away as rapidly as the soft brush and therefore develops a glaze on the face that is not particularly conducive to good commutation.

Double Brush Holder

The invention of the double brush holder has resulted in a marked improvement in commutation (see Fig. 3). This brush holder increases the likelihood of more brushes being in contact with the commutator at any instant and also provides a longer path through which the short-circuited currents of the armature coils undergoing commutation must travel.

The importance of having several brushes per polarity cannot be overemphasized. Motors of 5 hp. or larger should have at least two brushes per polarity. If one brush is knocked off the commutator, the

Fig. 3—Sanding commutator brushes.

(Intimate contact between brush and commutator is assured when brushes are carefully sanded in with #0 or #00 sandpaper. Paper is placed sanded face up and held firmly against the commutator, then pulled circumferentially in the direction of rotation; not across the brush face. Return stroke should be made with the brush lifted from the surface of the sandpaper. Never use emery cloth as metallic particles can short out the commutator bars and puncture the film surface. This brush-holder is of the double brush type.)

other one is in contact and carries the current. If all the brushes of one polarity are jarred from the commutator there is certain to be an arc formed between the brush and the face of the commutator in order to carry the current.

This problem is particularly true on machines that have but two brush arms, or one brush arm for each polarity. The motor having but two brush arms cannot possibly commutate as well as one having four arms. With two brush arms all of the brushes for one polarity are in contact with the same bars in the commutator. The chances of them being disturbed simultaneously are very great. This should not be taken to mean that it is impossible to operate motors with only two brush arms. The necessary crowding sometimes found in certain types of machinery makes it highly desirable to use but two brush arms. However, the fact still remains that the machine would operate better from the standpoint of commutation if it had four brush arms, or two per polarity.

Replacing Brushes

It is quite easy to replace an old brush with a new one and walk away from it and let it wear itself so that its face has a contour agreeing with that of the commutator. This is particularly true if several brushes are being replaced simultaneously and especially so if they are all being replaced. Sparking with its resultant burning of the commutator is sure to occur if unfitted brushes are applied to the machine. The brushes should be sanded to the contour of the commutator by first grinding the face of the brush with rough sandpaper placed between the commutator and the brush as shown in Fig. 3. The sandpaper should be pulled in the direction of rotation. At the same time it should be held firmly against the face of the commutator. The return stroke should be made with the brush lifted from the surface of the sandpaper. After the rough grinding has been finished and the brush has the general shape of the surface of the commutator, the remainder of the grinding should be done with fine sandpaper. While it is permissible to apply additional pressure to the top of the brush during the rough grinding only the pressure of the brush finger should be used during the finish sanding.

It is impossible to grind in brushes so they will have a polished face before the machine is operated. However, a simple check can be made to determine whether the brush has been ground in satisfactorily. When it appears that the brush has geen ground in properly, the machine should be operated for one or two minutes and then shut down. If upon observation of the face of the brush polished streaks are apparent between the trailing and leading edges, and these streaks form a uniform pattern all the way across the width of the brush face, a proper job has been done and the machine can be operated without fear of trouble so far as this grinding-in operation is concerned.

There are a number of problems that must be faced relative to the operation of motors. One is the riding of the brushes on the commutator. Commutators are never perfectly round. Even when new the manufacturer allows a tolerance of about .001 in. eccentricity. If the machine has operated for a time the eccentricity combined with other irregularities, may reach .002 in. or .003 in. Carbon brushes have a resiliency that makes them particularly well suited to follow these irregularities. They must absorb the movement of the commutator face to a degree without moving the entire brush to the same degree. The brush acts as a sort of a spring to that it contracts and expands itself in following the irregularities of the commutator. Some of this motion of course reaches the pressure finger and results in a slight motion up and down.

Proper Film on Commutator

The chocolate brown color so highly desired on the face of the commutator is in reality an ozide film which has been layed down by the brushes. The presence of this film helps to reduce the friction between the commutator and the brushes. However, conditions arise sometimes when this film is irregular and uneven. This results when the brush density is less than about 5 ampere per square inch and may be encountered when a machine operates for a considerable period of time without load. The effect of this irregular film is to make the brushes chatter. Sparking and consequent burning may occur and the brushes may chip and break up. Regardless, operating conditions may make it necessary for a machine to run at light load for considerable periods of time. To insure a satisfactory film under such conditions, select a brush that has a slight abrasive in it. This will permit a proper film to be deposited on the commutator, yet there will be sufficient scouring action to keep it smooth and even.

The presence of uneven film on a commutator can be detected by feeling the brush as it rides the commutator. If it feels rough, sandpaper the commutator as this removes the film entirely. If it feels smooth after sanding the evidence is conclusive that it is irregular film that caused the vibration of the brushes. If, however, the sanding operation did not result in a change of vibration of the brushes, then the conclusion can be drawn that such vibration was not due to film, but to irregularity in the surface of the commutator.

Avoid Sanding and Grinding

Frequent sanding and grinding of the commutator should be avoided if at all possible. Sanding a commutator is not too harmful, but grinding with a hand stone is particularly injurious because this action actually cuts away small particles of copper. These particles of copper can be, and some always are, drawn into the windings of the armature where they can cause shorts and grounds. This danger is particularly great in machines that have open risers between the bars and the ends of the armature coils. It has been the experience of many users that armatures fail soon after hand stoning.

Brush potential curves are a very useful means of determining whether the interpole strength is proper for best results. To obtain values for such a curve it is necessary to use a high resistance voltmeter with a range of about 3 volts. The readings taken are of the voltage drop between the brushes and the commutator. To obtain these one terminal of the voltmeter is attached to the brush rigging and the other to a pointer which must be insulated to permit holding it in the hand. This pointer is gently applied to the rotating commutator, first at a point near the leading edge of the brush where it contacts a bar. A reading is taken. This is point number one on the curve. The pointer is then moved to the center of the brush and a reading taken. This is point number two. A third reading is taken near the trailing edge of the brush and is recorded as point number three. Regardless of the direction of rotation the curve is plotted with point number one to the left and point number three to the right. If the commutating pole strength is too great the curve will slope downward from point one to point three. If the machine is undercompensated then the curve will slope upward from point one to point three. The most desirable curve is one that has

a slight downward slope from number one to number three.

Occasionally turns of a commutating coil are removed if the lead happens to be burned off. For example, if the lead is off a coil that has 24 turns, one turn may be unwound in order to provide a new lead. This should not be done for the reason that the removal of one turn in the coil very materially alters its commutating effectiveness. Approximately eighty per cent of the turns on the coil are necessary to suppress the armature mmf before any effect is made by the coil on commutation. Only the last twenty per cent of the turns on the coil are effective in aiding commutation. When the coil has but twenty-four turns, only about five are effective for correcting commutation. If one turn is removed it changes the effectiveness of the coil twenty per cent. Therefore, it is obvious that this is a questionable practice that will undoubtedly result in sparking and burning of the commutator.

Another source of poor commutation not commonly recognized is inadequate soldering of leads to the commutator bars. This increases the resistance thereby changing the flow of current between the coils and the bars. Thus, the bar with the poor joint does not carry its full share of current. If the joint is poor bits of melted solder will be found around these joints.

Another cause of poor commutation is a short in the main field winding. This upsets the equality of the flux around the armature thereby resulting in poor commutation. It is frequently found in motors around the 5 hp. size.

Good commutation insures continuity of service and only results when a planned maintenance program is followed assiduously.

WATER AND SEWAGE PATENTS

(OF RECENT ISSUE)

WATER PATENTS

Flowmeter. Nathaniel Brewer (to Fischer & Porter Co., Hatboro, Pa.); U.S. 2,400,097; May 14, 1946 (Appl. 4-18-44). A fluid flowmeter utilizing the rotameter principle.

Wide Range Flow Meter. Sten Elowson (to Pittsburgh Equitable Meter Co., Pittsburgh, Pa.); U.S. 2,400,108; May 14, 1946 (Appl. 9-4-42). A flow meter having a tube of uniform bore and a parabolic slot therein, an elongated piston of tapered construction, with a second piston therein, the flow depending on movement of tapered pistons.

Self Priming Centrifugal Pump. Arthur J. Nelson, San Mateo, Calif.; U.S. 2,400,434; May 14, 1946 (Appl. 6-7-44). A centrifugal pump with housing arranged to hold residual water for priming.

Method of Treating Waters Including Boilers, and Composition Thereof. Wayne L. Denman (to Dearborn Chemical Co., Chicago, Ill.); U.S. 2,400,543; May 21, 1946 (Appl. 2-27-40). Process of treating water with an amount not to exceed 500 ppm. of a compound chosen from a group of aliphatic primary and secondary amines having at least six carbon atoms in the alkyl group.

Liquid Treatment. Frank D. Prager (to Graver Tank & Mfg. Co., Inc.); U.S. 2,400,598; May 21, 1946 (Appl. 2-4-42). An apparatus for liquid treatment by the formation and removal of sludge, utilizing passage of water through sludge flocculating zone.

These patent abstracts being brief do not necessarily cover the entire scope of the invention described. If the reader becomes especially interested in any of these patents he should obtain printed copies of the complete patent, at 25 cents each, from the Commissioner of Patents, Washington 25, D. C.

Apparatus for Screening Fish from Streams of Water. John D. Toft, So. Portland, Maine. U. S. 2,402,099; June 11, '46; (Appl. 8-21-45).

Ion Exchange Polyamine Resins and Method of Preparing Same. John W. Eastes (to Resinous Products and Chemical Co., Philadelphia, Pa.). U. S. 2,402,384; June 18, '46; (Appl. 4-6-44). Method for preparing an ion exchange resin from a methylol-forming phenol, an alkylene polyamine, and formaldehyde.

Centrifugal Pump. George H. Garraway (to H. K. Porter Co., Inc., Pittsburgh, Pa.). U. S. 2,402,995; July 2, '46; (Appl. 9-9-44).

Combination Pressure Tank and Pump. Arthur P. Ruth. U. S. 2,403,555; July 9, '46; (Appl. 2-26-45).

Centrifugal Pump. Arthur D. Ruth, Houston, Tex. U. S. 2,403,556; July 9, '46; (Appl. 12-17-45).

Water Purification. Walter B. Durant and William A. Blann (to American Cyanamid Co., New York). U. S. 2,404,367; July 23, '46; (Appl. 10-7-42). A process for purifying water with less than 20 ppm. of total solids by passing it through a hydrogen zeolite and then through an anion active material which has been treated to adjust the water to a pH of 7.5, said reagent being an aqueous solution of carbonate and bicarbonate.

Liquid Treatment. John J. Felsecker (to Graver Tank & Mfg. Co., Inc., Chicago). U. S. 2,404,701; July 23, '46; (Appl. 1-10-44). Apparatus for liquid treatment comprising a tank having a peripheral wall and an annular baffle disposed within, so that water discharged into outer circular segment of the tank travels downward and through a slurry bed of precipitated solids and reagents, and upward in central zone, where it is clarified.

SEWAGE PATENTS

Treatment of Winery Slops. Ellis C. Pattee (to National Distillers Products Corp.). U. S. 2,404,398; July 23, '46; (Appl. 3-29-43). Process for obtaining usable by-products from winery residues, including winery still slops containing potassium acid tartrate.

EVALUATION OF SEWAGE WORKS DATA

By GEORGE E. SYMONS, Ph.D.
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WATER & SEWAGE WORKS
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IN the Sept. 1945 issue of *Civil Engineering* (p. 399) Messrs. William L. Havens and Frank Woodbury Jones presented some very pertinent considerations on "Getting the Most Out of Sewage Works Data." As partners in the consulting engineering firm of Havens and Emerson, in Cleveland, they are well aware that "frequently a study of reports from a sewage treatment plant reveals omissions and discrepancies, which make it difficult to draw useful conclusions."

These authors state that "sewage works data should be obtained, recorded, preserved, and examined frequently for three chief purposes: (1) To serve as evidence of past performances, (2) To show current accomplishments as regards adequacy, economy, and effectiveness of treatment processes; and (3) To determine the need for extensions and improvements and to provide a sound basis for design of such betterments."

In their paper Messrs. Havens and Jones made "an appeal to greater care in the accumulation of data, to the end that, the information may be utilized more effectively . ." With their intent, their appeal, and their conclusions this writer has no quarrel. Neither is it a criticism to point out that they have presented their appraisal of data and its evaluation principally from the point of view of the designing engineer rather than the analyst. This attitude is understandable and appropriate, but it leaves the matter open for discussion from the point of view of the plant operator and laboratory analyst. This discussion will therefore be concerned with a comparison of this point of view with that taken by the authors of the paper.

In the above listed chief reasons for the collection, preservation, and examination of sewage works data, the authors do not omit the concept of improving operation but it would seem worth further emphasis. From the operator's point of view, data when properly compiled and interpreted may be most useful in betterment of the plant operation long before there is any improvement in design or reconstruction. In short, proper use of routine data may allow for research into the matter of improving operations of the plant with which one has to work.

In the matter of chemical analyses to be made, Havens and Jones have omitted one important determination in the list of analyses "appropriate to the problem at hand"—namely chlorine demand; likewise the determination of settleable solids should not be overlooked.

Laboratory Work

There is no doubt that "for complete and effective evaluation" of results, analyses should be made of samples collected at all points indicative of major treatment and the number of tests made should be sufficient to obtain information on what happens to various constituents of sewage.

In simple words it must be pointed out that, "That's a lot of work," and a realization of the amount of that work must be kept in mind when considering the following comments of the authors: "Another important link in the chain of information is the laboratory. This link may be weakened by carelessness, or sloppy and inept procedures. Witness the laboratory assistant who constantly misread his balance weights, and which is quite common, made mistakes in simple calculations. A laboratory, even one fully equipped with all necessary apparatus, becomes of little account if the work is done without due regard to the necessity for careful and correct technique."

There is but one answer to these comments. Engineers cannot blithely say on one hand that the janitor, the office boy, or an operator can be easily taught to do sewage analyses, and on the other hand, ask for careful work, free of sloppiness. Larger plants should have trained chemists, and smaller plants should have operators taught in short schools and certified for their positions.

Sampling

There is no doubt that in the chain of information the sample is the first important link. Whether automatic samplers will obviate the weakness of this link cannot yet be fully answered, and as the authors point out human samplers are not always reliable. From this writer's experience, too, numerous instances may be cited wherein the human element was the weakest link in the sampling. Weakness ran all the way from the downright dishonesty of a sampler to misplaced good intentions. The former was exemplified by the man, who on a night shift during an industrial waste survey, took over at midnight and slept in the truck until 7 a.m., then filled all eight sampling bottles and recorded faked flow data. It was his lack of knowledge of sewage flow that tripped him, for his guesses on flow data were quite wrong, and the samples didn't "look right" to the chemist.

In the case of the good intent gone wrong, one may cite the sampler who had heard the chemist discussing B.O.D. and aeration. He noticed that when he took a sample of flow from a V-notched weir discharge, the sample was aerated in the bottle, so he plunged the sample bottle beneath the surface behind the weir; in so doing he plunged the bottle too deep and half filled it with garbage particles that had settled behind the weir over a period of two weeks. The sample was hardly representative.

Domestic and Storm Loads

On many occasions, engineers have set up a series of evaluations of data from which it appears possible to ascertain domestic, industrial, and storm loads separately by the proper tabulation of the data. Such formulas are correct only if certain assumptions are made. These assumptions are that on Sunday all industrial activity stops, and all domestic, i.e., human activity, is the same as during the week, but not all industrial activity ceases on Sunday and it may also be doubted that the household activity is normal. Persons who rise late, eat only two meals, are less active, drink less water, wash less often, use the toilet less often, certainly are not discharging the normal amount of sewage per capita. Perhaps this is not an important factor and yet it should not be entirely overlooked. The assumption of Sundays as a normal domestic day may lead one to assume that any season is as normal as another.

Such an assumption in one instance led to a question as to the ac-

curacy of data on one large sewer serving a population of over 100,000 because the population equivalent, both as to B.O.D. and suspended solids, was 10,000 less in the summer than in the winter. Careful consideration of all factors showed that the exodus of college students from the area plus the exodus of persons to summer homes could readily account for the difference.

Analysis of Composite Samples

Quite often tabulated data will show that analyses of a composite sample give comparable results to analyses of the individual samples, but there are certain warnings that must be expressed in this connection. Data for individual samples of twenty-four hour composites are less likely to agree than composites and individual samples over shorter periods of five to eight hours.

This writer has shown that composite samples are of no value for bacteriological results or for the determination of chlorine demand. Dr. W. D. Hatfield at Decatur, Ill., has shown that unless composite samples are kept at temperatures below 4° C., there will be a decrease in B.O.D. Dr. Anthony Fischer of the Dorr Co. has shown that flocculation of colloids occurs during long standing. Such flocculation obviously affects the suspended solids test. There seems to be no better way at present, however, than to accept as approximately true, the analysis of composite samples, because individual grab samples are meaningless as to operation of a sewage treatment plant.

Solids Balance, Sampling, Analytical Technic

In the matter of solids balance, as Messrs. Havens and Jones point out, data on suspended solids, total solids, and actual sludge measurements frequently show wide discrepancies, thereby leading to the belief that the analytical data are untrustworthy. While not insisting that all analytical data are correct, at the same time it may be pointed out that several factors contribute to this discrepancy in data. The first of these is location of sampling point.

Where samples are collected by hand, by the immersion of a sample bottle or sampler, it must be remembered that sewage flowing through a conduit does not necessarily have the same composition from top to bottom and this difference is more noticeable where analyses for grit removal are made. Because of the difficulty of obtaining samples that had the proper proportion of grit therein, the practice at Buffalo, N. Y., has been to analyze the grit free sewage, analyze the grit (which was weighed), and calculate the suspended solids content of the raw sewage.

Another factor to be considered is that of laboratory technic where the test portions are removed from the sample bottle for analysis. It has always been customary practice to shake the bottle of sewage or sludge and then pour or pipette out the sample, or insert a volumetric flask into the neck of the sample bottle and invert to fill the measuring flask. Any of these technics will introduce errors into the test by reason that none overcomes the tendency of suspended solid particles to settle during sampling.

To obviate this difficulty, Dr. W. D. Hatfield has introduced the technic of mixing the sample with an electric stirrer in the sampling container and withdrawing the test portion by siphon, while the sewage sample is in motion and settling prevented. This technic has the advantage that all samples withdrawn are of the same composition as to suspended matter contained.

There is one other factor that may affect the results in a suspended solids test. The use of the Gooch crucible has its limitations. Results of studies have indicated that the suspended solids results depend on the thickness and porosity of the Gooch mat. Studies made by Smith in Chicago developed the use of an aluminum dish and filter paper for suspended solids in activated sludge. This technic was adapted for use in the determination of suspended solids in raw and settled sewage at Buffalo. The results were uniformly good, for one reason because larger samples were used for the test than are usually used, and for another, because the sampling error was correspondingly reduced. While this technic has been accepted for activated sludge solids, in the 9th Ed. of Standard Methods, it certainly should receive further study for its application to raw sewage.

Messrs. Havens and Jones also point out that sampling of sludge by the operators is not always satisfactory. This is likewise true in the laboratory. Shaking of a sample bottle of sludge followed by pouring will not give a true sample of the sludge in the bottle. The neck of the bottle acts as a dam holding up the heavier particles. Shaking followed by thiefing with a glass thief sampler produces analytical results that are more nearly correct than does any other method of sampling.

Costs

The writer is in agreement with the idea of reporting costs on per capita basis. Actually where strong industrial wastes are included in the sewage it would seem that to report the cost of operation on a Population Equivalent basis would serve better for comparison of one sewage treatment plant with another. But it should be remembered that it is not strictly possible to compare two treatment plants that do not have the same type of treatment or the same problems of waste concentration.

Weighted Data

There is one other consideration to be given to the evaluation of sewage works data. It has generally been quite common to determine the analytical results in ppm. and then ascertain the mathematical average of these concentrations as a measure of plant operation. Straight mathematical averages are often incorrect. Weighted averages are the only true averages. These averages must be weighted according to the flow represented by the analyses. The use of quantity units (lb. per day, for example) is a more desirable practice. A full realization of this fact becomes evident from the following simple example:

	Flow mgd.		ppm.	Quantity Unit
1st day	2	×	300	600
2nd day	3	×	200	600
2 day avg.	2.5	×	250	...
Wtd. avg.	2.5		240	600

Obviously the average flow is 2.5, but whereas the mathematical average of the ppm. is 250, the true weighted average is 240 ppm. Another means of reporting the average results for a month, for example, is to use the median values of the series of observations. The median is much nearer to the weighted average than is the mathematical average in most cases. The latter approaches the median and the weighted value only when the two variables (flow and concentration) are relatively constant.

Reports:

Too often the data from properly collected and properly analyzed sewage samples are buried in improperly designed record sheets. In other instances, laboratory and operating data that have direct relationships to each other are not recorded in a manner to indicate those relationships. In either case poor operation may result because the information needed is not properly at hand.

Whereas it may be desirable to

collect data on many analyses and on many phases of operation for research purposes, perhaps not all of the analyses have a direct bearing on plant operation and such data, therefore, should not clutter up the operating report. For example, in a treatment plant using only primary treatment, the determination of nitrogen may be desirable for long range research studies, but it has little if any bearing on the operation, whereas suspended solids and flow are vitally important.

In the averaging of tabulated data, it is mathematically incorrect to obtain an average per cent removal (a per cent reduction or per cent kill of bacteria) by averaging the daily per cent removals. The true average per cent removal may be obtained only by determining the weighted average values of, for example, influent and effluent analyses, and then calculating the per cent removal.

The complexity of reports will vary with the size of plant and type of treatment. Suggested forms for small plants have appeared in the Reference and Data section of this magazine in April, 1946, and a system of multiple page records for a large plant was published by this writer in *Sew. Works Jour.* in 1941.

One may well agree with the conclusion expressed by Messrs. Havens and Jones "that there is no point in amassing voluminous data unless those data present a true story of what has happened, what is now taking place, and what is likely to occur in the future."

"Water, Water Everywhere; But . . . . . ."

Didya ever visit a filtration plant and with water, water everywhere, wonder where a fellow might get a good drink of it? Well, we often have and have had to ask the host where a drink could be had.

On a recent visit to one plant we were so impressed with the electrically cooled drinking fountain, so conspicuously and conveniently located, that we obtained the accompanying picture showing this fountain where the press of a foot pedal would bring forth a cool, sparkling stream of *Aqua Pura* for the benefit of the visitor.

Not only of interest was this fountain, but also the open air filter operating gallery and the uncovered filters of the Miami Filtration Plant operated under the supervision of C. F. "Dutch" Wertz, currently chairman of the Florida Section of AWWA.

Opportunities for Sanitary Engineers

Vacancies in Institute of Inter-American Affairs

Word has been received from C. I. Sterling, Jr., Chief Engr. and Assoc. Director of the Division of Health and Sanitation, Institute of Inter-American Affairs, that there are several vacancies in the division for sanitary engineers.

One vacancy exists for a sanitary engineer who has specialized in the design of water supply and sewer systems, a second engineer is needed who has experience in public health and general engineering activities, and a third is desired with experience in the construction of water and sewage works. One position is available in Washington while the others are located in Latin American countries.

Salaries range from $4,149.60 to $7,102.20 per annum, plus a living allowance while serving abroad. Transportation of families to the post of duty is paid by the government.

New Sanitary Engineering Laboratory at Hopkins

To be in Charge of Dr. Chas. Renn

Doctor Abel Wolman, Professor of Sanitary Engineering, The Johns Hopkins University, announces the opening of a new sanitary laboratory in the Department of Sanitary Engineering. These laboratories are designed for graduate study and research in sanitary engineering and water resources problems, particularly with those relating to the chemistry and biology of water supplies, sewage disposal systems, polluted waters, industrial wastes, and the ecology of estuaries. Courses offered in the laboratories will complement those offered by Professor Wolman and Associate Professor Geyer by furnishing formal and research training in the bacteriological, biological and chemical techniques basic to sanitary engineering. A unique feature of the work is the extension of facilities for mutual study of water resources problems by those interested in conservation, waterways improvement, shellfish, and others involved in the control of public waters.

Dr. Chas. E. Renn

The new laboratories will be in charge of Doctor Charles E. Renn, lately Associate Biologist of the Massachusetts Department of Public Health, Division of Sanitary Engineering, and Lecturer in Sanitary Biology, Harvard University.

SURVEY OF ELEMENTARY MATHEMATICS

For Water and Sewage Works Operators

Part V

BY WARREN K. EGLOF, PH.D.
Prof. of Chemical Engineering
NIAGARA UNIVERSITY, N. Y.

ELEMENTARY HYDRAULICS

Head

Pressure at depth h below the surface of a liquid is given by

$P = dh$ where

P = pressure in lb./ft.²
d = density in lb./ft.³
h = depth in ft.

Then lb./ft.² = lb./ft.³ x ft.
d = 62.34 lb./ft.³ for water at 60°F.
P in lb./in.² = 1/144 x lb./ft.²
P in lb./in.² = 0.433 x ft. depth
Feet depth = P in lb./in.² x 2.31.

The feet of water necessary to produce a specified static pressure is called the "head." The term head has a more general and useful meaning. Strictly interpreted, it means foot-pounds of energy per pound of fluid.

Energy is that which can be converted into heat. There are only two fundamental forms of energy (a) energy due to motion, (b) energy due to position when force is acting. Energy of motion is kinetic and energy of position is potential.

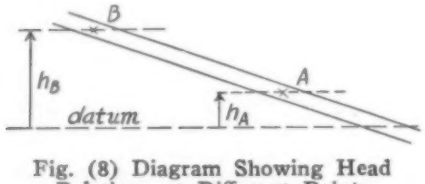


Fig. (8) Diagram Showing Head Relations at Different Points

Consider Fig. 8, in which water is flowing in a pipe. A and B are two stations on the line. The datum is a horizontal reference plane. Each pound of water at B is elevated h_B feet above the datum plane and is acted upon by a pound of force due to gravity. Each pound of water elevated h feet possesses h ft.-lb. of potential energy and is said to have a potential "head" of h feet. If the water at B is moving, it has kinetic energy in ft.-lb. equal to $V^2/2g$ for each lb. V = velocity in ft./sec. and g (gravity) is 32.2 ft./sec./sec. This kinetic energy in ft.-lb. per lb. of water is the "velocity head."

In addition, the water at B exerts a static pressure equal to P/d. This latter is the "pressure head."

Two other heads are usually involved when water flows. When any liquid flows, there is friction. Friction in a moving liquid means that energy is being converted into heat. If the potential, velocity and pressure heads are added for a liquid at a given point, we have the total ft.-lb. of energy per lb. of liquid at that point. As this pound of liquid moves, it steadily loses energy through friction. This is what is meant by "loss of head."

Every length of pipe, channel, elbow, valve, baffle, or anything that increases turbulence or any sudden change of cross-section or orifice, is responsible for loss of head. This loss of head due to friction is permanent.

A pump is used primarily to increase available head and is a device for adding ft.-lb. of energy to each lb. of water passing through. We can properly speak of "friction head" and "pump head." Friction heads for pipe and fittings are readily obtained from manufacturers' bulletins and data books. (See *Water Works & Sewerage*, Vol. 91, p. R-28, June, 1944, for a complete discussion of Loss of Head.)

The various heads along a hydraulic system are not independent. They are related by Bernouilli's Theorem. Consider Fig. 8. Points B and A are on a straight pipe of uniform cross-section. The horizontal datum plane may be taken anywhere. Water is flowing from B to A.

$$h_B + \frac{V^2_B}{2g} + \frac{p_B}{d} - F = h_A + \frac{V^2_A}{2g} + \frac{p_A}{d} \qquad \text{Eq. (1)}$$

This equation simply states that the sum of the potential, velocity, and pressure heads at B minus the friction head is equal to the sum of the three heads at A. Since the cross-sections at A and B are equal, $V_B = V_A$ and the equation becomes

$$h_B + \frac{p_B}{d} - F = h_A + \frac{p_A}{d} \qquad \text{Eq. (2)}$$

If A and B were at the same elevation, h_A would equal h_B and the equation would become

$$\frac{p_B}{d} - F = \frac{p_A}{d} \text{ or}$$

$$\frac{p_B}{d} - \frac{p_A}{d} = F \text{ feet} \qquad \text{Eq. (3)}$$

Equation (3) tells us that the pressure drop on a horizontal line of uniform cross-section is due entirely to friction.

Venturi Meter

In the Venturi meter, the throat at B has a smaller cross-section than

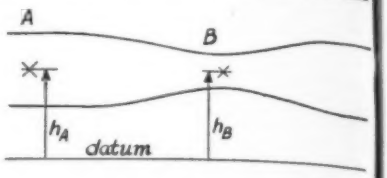


Fig. 9. Venturi Meter

at A. Because the same quantity of water flows through both sections, we have

(velocity × area)$_A$ = (velocity × area)$_B$

The velocity at B is greater than at A.

From Bernouilli's theorem

$$h_A + \frac{V^2_A}{2g} + \frac{p_A}{d} - F = h_B + \frac{V^2_B}{2g} + \frac{p_B}{d}$$

$h_A = h_B$
F = small

$$\frac{p_A}{d} - \frac{p_B}{d} = \frac{V^2_B}{2g} - \frac{V^2_A}{2g} \text{ or}$$

omitting friction

$$\sqrt{V^2_B - V^2_A} = \sqrt{2g\left(\frac{p_A}{d} - \frac{p_B}{d}\right)}$$

including friction

$$\sqrt{V^2_B - V^2_A} = 0.98\sqrt{2g\left(\frac{p_A}{d} - \frac{p_B}{d}\right)}$$

$$\frac{V_A}{V_B} = \frac{\text{area A}}{\text{area B}}$$

The last two equations show that the pressure drop between A and B and the two areas enable the velocity of flow to be calculated.

Problem: A 2 in. pipe on a horizontal run of 100 ft. has a flow of 80 gal./min. The pressure drop is 10.3 lb./in.² Calculate the head lost in friction and the horsepower consumed in this length of pipe.

lb./in.² x 144 = lb./ft.²
lb./ft.² of pressure drop ÷ density = ft. head lost
10.3 x 144 x 1/62.4 = 23.8 ft. head lost

This lost head means that for every pound of water passing through this length of pipe, 23.8 ft. = lb. of energy go into heat.

80 gal./min. = 80 x 8.33 lb./min.
80 x 8.33 x 23.8 = ft.-lb./min.

$$\frac{33000 \text{ ft.-lb./min.}}{80 \times 8.33 \times 23.8} = 0.481 \text{ horse-power}$$

$$\frac{33000}{33000} = 1 \text{ horse-power}$$

Problem: A 2 in. pipe delivers 80 gal./min. Calculate the linear velocity of flow in ft./sec.

80 gal./min. = 80 x 1/7.48 x 1/60 ft.³/sec.
cross-section = 3.1416 x (1/12)² = ft.²
ft.³/sec. divided by ft.² = ft./sec.
80 x 1/7.48 x 1/60 x 144 x 1/3.1416 = 8.17 ft./sec.

Problem: The influent valve on a filter is closed. The water surface requires 4.5 minutes to drop 1 foot. Calculate the rate of filtration in gal./min. per ft.² of sand surface.

Rate of filtration is 1 cubic foot in 4.5 minutes per ft.².
7.48/4.5 = 1.67 gal./min. per ft.²

If the sand area is 30 × 15 ft., what is the 24 hour rate in millions of gallons?

$$\frac{1.67 \times 60 \times 24 \times 30 \times 15}{1{,}000{,}000} = 1.077 \text{ mgd.}$$

What is the rate in millions of gallons per acre per day?

$$\frac{30 \times 15}{43560} = \text{acres} = 0.0103$$

$$\frac{1.077}{0.0103} = 104.3 \text{ mgad.}$$

AVERAGES AND MEANS

Arithmetic Mean

An average is a single number used to represent a group of measurements or data. Averages are of different kinds. The commonly used average is the *arithmetic mean.* It is what is usually meant by the "mean" or "average." If X, etc., are the values of the individual measurements and N is their number,

$$\text{arithmetic mean} = \overline{X} = \frac{X_1 + X_2 + X_3 + \text{etc.}}{N}$$

If X_1 appears f_1 times, etc.,

$$\overline{X} = \frac{X_1f_1 + X_2f_2 + X_3f_3 + \text{etc.}}{N}$$

where N = sum of all f's

Weighted Averages

This last equation shows that each X must be weighted according to the number of times that it occurs. In the following table the rate of pumping is constant beginning on the hour and continuing until the next recorded hour.

Hour	mil. gal./hr.
12 midnight	2.0
1 A.M.	2.5
3 A.M.	2.7
6 A.M.	3.0
7 A.M.	7.0
12 Noon	6.0
2 P.M.	4.0
5 P.M.	3.0
9 P.M.	2.0

The average desired is the mil. gal. per hour over the 24 hour period. If we merely added the values in the table and divided by 9, we would get 3.58. This would not be correct because the rates given in the table did not hold for equal times. Each rate must be weighted according to the hours run at that rate.

2.0 x 1 = 2.0
2.5 x 2 = 5.0
2.7 x 3 = 8.1
3 x 1 = 3.0
5 x 7 = 35.0
6 x 2 = 12.0
4 x 3 = 12.0
3 x 4 = 12.0
2 x 3 = 6.0
Sum = 95.1

$$\text{Weighted average} = \frac{95.1}{24} = 3.96 \text{ gal. per hr. for the correct average.}$$

The Median

Another type of average is the *median.* This is determined by arranging the values in descending order and selecting the value half-way down. Another method of obtaining the mean is to cross out the largest and smallest values, continuing until only one is left. If two are left, the average of these two is taken. Half the values are larger than the median and half are smaller. It has the advantage of not being affected by an abnormally large or small value of a single quantity.

The Mode

Another representative value is the *mode.* The mode is that value which in any series of observations occurs more often than any other. Its chief use in sanitation studies is in connection with the M.P.N. (Most Probable Number) values for Coliform density. In general operation practice it is not customary to use the mode. Arithmetic averages are commonly used.

In the determination of the arithmetic mean M.P.N. for a month, it must be remembered that the M.P.N. for each day or sample must be determined and the sum of the M.P.N.'s divided by the total number of days or samples. It is not permissible to average the tube readings for the month and determine the M.P.N. therefrom.

QUANTITY UNITS

In sanitation studies, the characteristics of a water or sewage are usually expressed in concentration units. A common concentration unit is parts per million (ppm.). For some studies, the total pollutional load or some figure that is proportional to this quantity is desirable. For this purpose, *quantity units* are used. A quantity unit involves both concentration and total flow. When applied to the biochemical oxygen demand, a convenient unit would be the lb. of B.O.D. per day in the total flow.

ppm. x 8.34 x mgd. = lb. B.O.D. per day
or ppm. x cfs. x 5.4 = lb. B.O.D. per day

An arbitrary unit ppm. × cfs. is used by some workers.

A quantity unit used in the bacteriological study of polluted streams is the total bacteria passing through a square-foot section in 24 hours when the velocity of flow is 1 ft. per sec. and the organisms are 1,000 per ml.

$$1000 \times 28{,}350 \times 86{,}400 = 2.45 \times 10^{12}$$

1 Q.U. here is 2.45×10^{12}

Another simpler arbitrary unit is

$$\frac{\text{organisms per mil.}}{1000} \times \text{cfs.}$$

For comparison purposes, arbitrary units may be used as long as they involve both concentration and flow.

In sewage works, pounds of suspended solids removed per day, pounds of dry sludge solids per day, and pounds of B.O.D. removed per day are all quantity units. From day to day, per cent removals may be calculated from concentrations (ppm. or bacteria per ml.), but the average per cent removal may be calculated only from the *weighted average* concentration or from quantity units. It cannot be determined from the arithmetic mean of the per cent removal. Unless flows are constant from day to day or approximately so the average concentration (ppm.) is correct only when determined by weighing, i.e., from quantity units.

DRYING AND DIGESTION OF SLUDGE

Problem: Sludge run onto a sand bed contained 92 per cent water and after drying contained 70 per cent water. What per cent of the water originally present was removed?

The wet sludge contains 92 lb. of water to 8 lb. of dry solids. The dried sludge contains 70 lb. of water to 30 lb. of dry solids.

92/8 — 70/30 = lb. of water removed per lb. of dry solids.
11.50 — 2.33 = 9.17.
9.17/11.50 x 100 = 79.7% removal.

Problem: Completely dried raw sludge contained 75 per cent volatile matter. The completely dried digested sludge contained 60 per cent volatile matter. What per cent of the volatile matter was removed; i.e., what was the per cent digestion?

100 lb. of the raw dry sludge contains 75 lb. volatile matter and 25 lb. of ash.

75/25 = lb. volatile per lb. of ash for the raw sludge.
60/40 = lb. volatile per lb. non-volatile for the digested sludge.
75/25 — 60/40 = 3.0 — 1.5 = 1.5.
$\frac{1.5}{3}$ x 100 = 50% digestion of vol.mat.

The Editor's Comments

"Silent Service Is Not Enough!"

Enthusiastically do we choose as this month's topic the dictum, *"Silent Service Is Not Enough!"* which the American Water Works Association has taken as the slogan in its planned program to develop a greater appreciation by the general public of the true importance which public water supply service has to the community and to the nation at large. In broad terms this program seeks the advancement of Public Relations between the water supply utility and the community. It constitutes a long belated attempt on a broad base to secure what has been so prevalently lacking—a greater recognition for the service rendered, and along with such recognition a higher appreciation of those comprising that host of silent and frequently little known men who have performed such service. As a natural outcome from a higher appreciation of the service, one must expect a greater tangible, as well as moral, recognition of those charged with the responsibility of maintaining a safe, wholesome and dependable water supply.

In A. W. W. A.'s Public Relations program there are three major objectives. The first is that of elevating the position of water supply service to that of highest rank in the eyes of the general public of any of the utility services. The second is to bring administrative officials, from the President of the United States to those of the smallest town or borough, to a better appreciation of what is to be found behind the water faucet; also, that the public water supply system should be managed and operated as a business enterprise rather than as a governmental service. The third and indirect major objective is that of securing for all individuals engaged in public water supply service more adequate compensation for services—compensation which justly should be more nearly on a scale for equivalent responsibility and service paid by industrial and commercial enterprise of the same or neighboring communities.

The Executive Committee of A. W. W. A. has authorized Secretary Jordan to make the estimated necessary expenditure to produce a series of documents designed to interest and help water works executives in the matter of developing local Public Relations programs. The first of these under the title, "Approaching the Public Relations Job," will probably be mailed to the complete membership in the Association before this issue reaches the reader. Having enjoyed the privilege of seeing an advance copy of the first document, it can be enthusiastically praised. The plan calls for a series of these Public Relations studies of a length which can be studied part by part, thereby simulating a correspondence course. In addition to the Study Series there will be issued from time to time Public Relations Reports under the general title, "Public Relations at Work." These will comprise factual reports revealing actual experiences, showing how members of A. W. W. A. are applying public relations practices in their particular communities. By filing this series, A. W. W. A. members will in time have the equivalent of a complete Public Relations Manual evolving from the "correspondence course" which members voted as preferable to waiting for the development of a complete manual at a later date.

At the risk of exceeding authority to quote from Study I, the writer must confess that he was so impressed by it that the urge to refer to certain sections of it is not to be denied. It makes the very truthful statement that public water supply has too long been taken as a matter of course; that water works managers have been content to let their work speak for itself. Until these two situations or conditions are corrected it is our belief that little can be done in the direction of developing the kind of Public Relations job which A. W. W. A. has set about to encourage and assist in securing. We suspect, too, that either sheer laziness, the lack of ambition, or the fear of having the spot-light thrown on them, have been responsible for the lack of interest of some water works executives in efforts toward the building of better Public Relations. There are still others who could ill afford to have the community spot-light thrown on the water utility because of the quality of the water supplied, the service, or the physical condition of the property. To those in this category, "Approaching the Public Relations Job" forewarns that since the public relations program is designed to create a higher regard and good will, then quality of water supply, service, and physical condition of the property must be improved, or, "as the dentifrice ads constantly remind us, the smile of friendship fails in its purpose if it releases a bad breath."

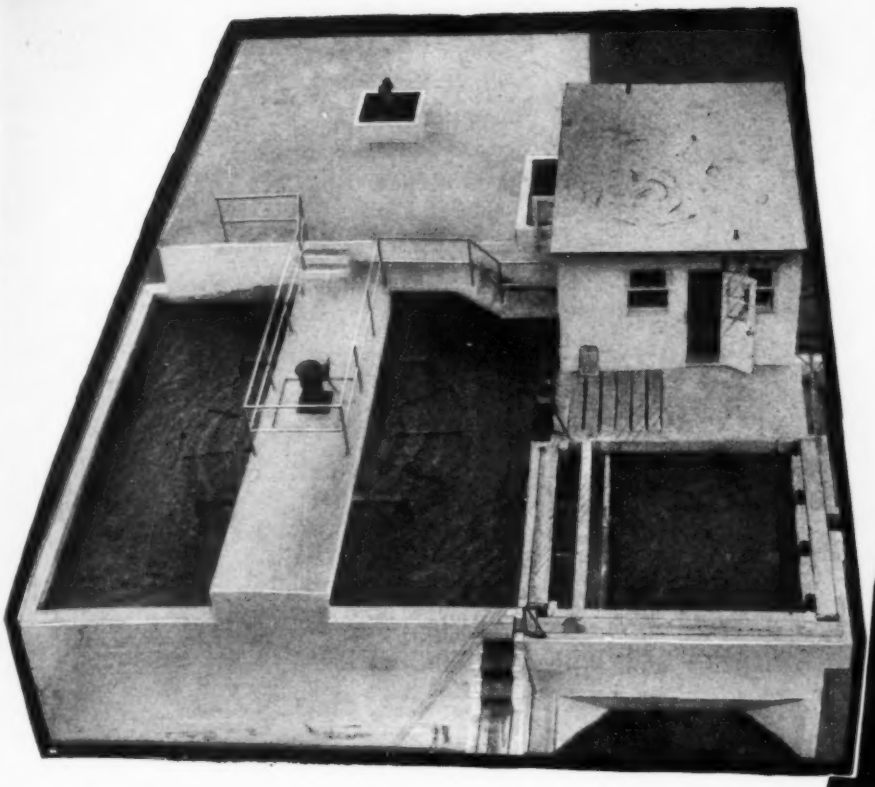
Only by satisfactorily answering the series of questions propounded can a water works manager feel that the undertaking of a public relations job is a show of good judgment. To answer these questions is in itself a start toward better public relations, for the reason that one's faults can only be corrected if a knowledge of such faults is first had. Thus, "An Introduction to the Public Relations Job" serves in more than one direction, the most important phase being that of first improving plant, property, service or personnel. In other words, it is the old axiom that "good public relations always start at home." No better ammunition in the hands of a superintendent can be thought of than this series of questions to place before a board, commission or council which has refused to take favorable action on recommended improvements to a water utility property or its policy, personnel or management.

On the other hand, says "Public Relations Study I," much can be done to inform and interest the public even though your internal organization may be far from perfect at the time. While you should not wait to do anything until perfection has been obtained, correction of unsatisfactory conditions should be made a major item in the program as it moves along. Further, an effective public relations program need not require a large budget to do a good job. Planning, thinking and making the most of opportunities are more important by far than mere money.

On this page has often appeared discussions of the need for local publicity and building of better public relations, toward the end of higher recognition and support of the water utility by the public. On this score we are particularly happy that A. W. W. A. is taking the defined organized action in the direction of "selling" the water utility to the general public.

"Silent Service Can Never Be Enough!"

L. H. Enslow



Chicago "Package" Sewage Treatment Plant at the Eastern Air Lines Terminal, Miami, Fla. The primary tank is in the right foreground. Behind it is the pump house. Left foreground is the Combination Aerator-Clarifier. Aeration and clarification are performed in this single tank. Behind it is the digester.

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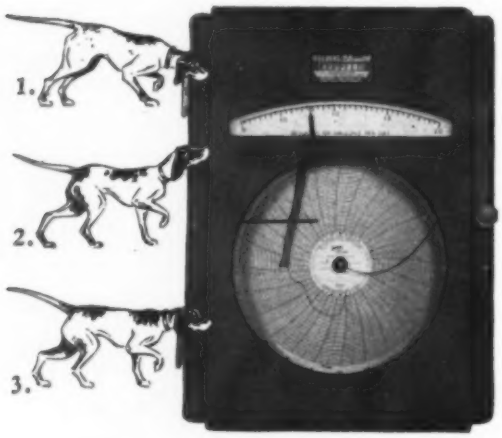

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MEETINGS SCHEDULED

Oct. 14-17—GALVESTON, TEXAS (Hotel Buccaneer)

Southwest Section A.W.W.A. Sec'y-Treas., Leslie A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 16-18—ATLANTIC CITY, N. J. (Hotel Traymore)

Pennsylvania Water Works Association. Sec'y-Treas., R. R. Hannum, 510 Telegraph Bldg., Harrisburg, Pa.

Oct. 16-19—KANSAS CITY, MO.

American Society of Civil Engineers. Sec'y & Exec. Officer, William N. Carey, 33 West 39th St., New York, N. Y.

Oct. 17—BOSTON, MASS. (Parker House)

New England Section A.W.W.A. Sec'y, R. H. Ellis, Inspection Dept., Associated Factory Mutual Fire Insurance Co., 184 High St., Boston, Mass.

Oct. 21-22—COLUMBIA, MO. (Daniel Boone Hotel)

Missouri Water & Sewerage Conference. Sec'y-Treas., Warren A. Kramer, State Dept. of Health, Jefferson City, Mo.

Oct. 23-25—SAN FRANCISCO, CALIF. (Hotel Whitcomb)

California Section A.W.W.A. Sec'y-Treas., Ray L. Derby, Box 3669 Terminal Annex, Los Angeles 54, Cal.

Oct. 24-25—HUNTINGTON, W. VA. (Hotel Pritchard)

W. Va. Section A.W.W.A. (Joint Meeting.)
21st Conference on Water Purification. Sec'y, J. H. Harrington, State Dept. of Health, Charleston, W. Va.

Oct. 28-30—PITTSBURGH, PA. (Hotel William Penn)

Engineers' Society of Western Penna. (7th Annual Conference.) Chairman, H. M. Olson, Wm. Penn Hotel, Pittsburgh, Pa.

Oct. 28-30—KNOXVILLE, TENN. (Hotel Andrew Johnson)

Kentucky-Tennessee Section, A.W.W.A. Sec'y-Treas., R. P. Farrell, Dir. of San. Eng., State Dept. of Health, 420 Sixth Ave. N., Nashville, Tenn.

Nov. 4-6—DES MOINES, IOWA (Hotel Kirkwood)

Iowa Section A.W.W.A. (1st Reorganization Meeting.) Chairman of Comm., H. V. Pedersen, Supt. Water Works, Municipal Bldg., Marshalltown, Iowa.

Nov. 7-9—ATLANTIC CITY, N. J. (Hotel Chelsea)

New Jersey Section A.W.W.A. Sec'y-Treas., C. B. Tygert, Box 178, Newark, N. J.
(Joint Meeting)
South Jersey Ass'n. of Water Superintendents. Sec'y, Walter Spencer, 2707 Bethel Ave., Merchantville, N. J.

MEETINGS SCHEDULED:

Nov. 11-15—CLEVELAND, OHIO (Public Auditorium)

American Public Health Association. (74th Annual Meeting.) Exec.-Sec'y, Reginald M. Atwater, 1790 Broadway, New York, N. Y.

Nov. 14—BOSTON, MASS. (Hotel Statler)

New England Water Works Association. Sec'y, W. C. Conroy, 609 Statler Bldg., Boston, Mass.

Nov. 14-15—RICHMOND, VA. (Hotel John Marshall)

Virginia Section A.W.W.A. Sec'y-Treas., W. H. Shewbridge, State Dept. of Health, 1506 Greycourt Ave., Richmond, Va.

Nov. 15-17—GREEN BAY, WIS. (Hotel Northland)

Wisconsin Section A.W.W.A. Sec'y-Treas., L. A. Smith, Supt. of Water, City Hall, Madison 5, Wis.

Nov. 18-20—RALEIGH, N. C. (Carolina Hotel)

North Carolina Section A.W.W.A. (Joint Meeting with) **North Carolina Sewage Works Association.** Sec'y-Treas., (both Assns.) Geo. S. Moore, Box 125, Albemarle, N. C.

Nov. 22-24—HAVANA, CUBA (Joint Meeting)

Florida Section A.W.W.A. Sec'y, Dr. A. P. Black, Univ. of Florida, Gainesville, Fla.
Cuban Section A.W.W.A. Sec'y, Laurence H. Daniel, P. O. Box 531, Havana, Cuba.

Dec. 2-6—NEW YORK, N. Y. (Hotel Pennsylvania)

American Society of Mechanical Engineers. Exec. Asst. Sec'y, Ernest Hartford, 29 W. 39th St., New York, N. Y.

Dec. 11—AUGUSTA, ME.

Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt. Water District, Winthrop, Me.

Dec. 19—BOSTON, MASS. (Hotel Statler)

New England Water Works Association. Sec'y-Treas., W. C. Conroy, 609 Statler Bldg., Boston, Mass.

Mar. 13-15, 1947—ST. PAUL, MINN. (Lowry Hotel)

Minnesota Section A.W.W.A. Sec'y-Treas., R. M. Finch, 416 Flour Exchange Bldg., Minneapolis, Minn.

Apr. 7-10—CHICAGO, ILL. (Palmer House)

The National Ass'n of Corrosion Engineers. Exec.-Sec'y, Elton Sterrett, 905 Southern Standard Bldg., Houston 2, Texas.

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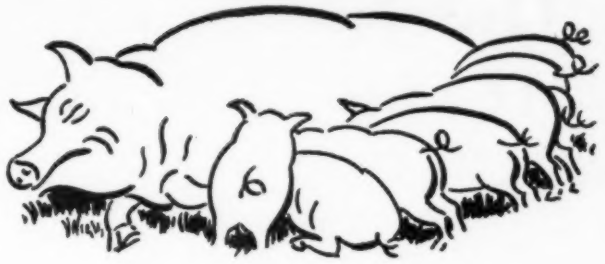

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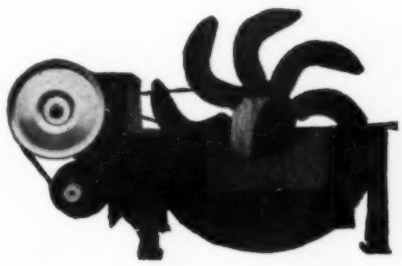

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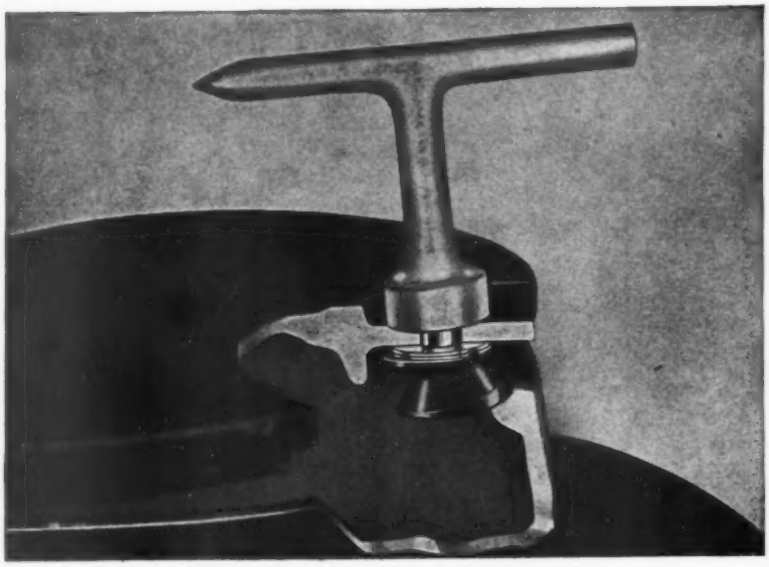

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Here and There with Doc Symons

Out in Indianapolis, Ind., there is an unusual man, who has an unusual story which he told as the after dinner speaker at both the Indiana Sect. meeting in April and the Cent. States Sew. Wks. Assn. meeting in June at Purdue. When I first heard him in April, I was so impressed, I sat down and wrote a letter to my son recounting the tale of "A Busy Day at Indianapolis" as told by W. Wilbur Shaw, Pres. of the Indianapolis Motor Speedway. Several persons who saw that letter suggested that I publish it— So, here 'tis.

A Busy Day at Indianapolis

"Dear Jimmy: When I was your age, the Indianapolis Auto Race was an exciting event in our lives. Why, I'd have given almost anything to have been able to talk to one of those racing drivers, but it was nearly thirty years before that opportunity came as it did the other night when I sat next to W. Wilbur Shaw at the annual banquet of the Indiana Sect. of AWWA at Purdue. I must confess I got a thrill out of it even then and it was interesting to talk to him about my onetime college roommate, Jimmy Snyder, "The Chicago Milkman," who was killed on a dirt track shortly after he had finished second or third at Indianapolis a few years ago. But the really exciting story was the one Shaw told the audience that evening. I thought you might like to hear it, too.

It was a busy day in Indianapolis! It is always a busy day in Indianapolis on May 30th, at least it was until the war and will be soon again. But this particular May 30th, it was 1931, was busier than usual; at least it was for W. Wilbur Shaw, not then one of the two three-time winners of the famous 500-mile Speedway Classic, but a determined little guy, with a heavy foot, and a favorite spot in the hearts of hundreds of thousand auto racing fans, who jammed Speedway Park each Memorial Day, or listened to the radio, or avidly read the newspaper stories of the big race.

Little did Shaw realize that before that afternoon was over his busy day would be one of the major miracles of

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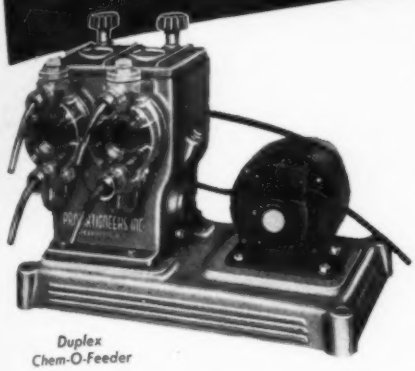

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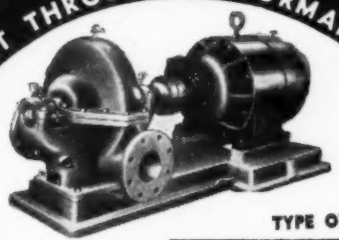

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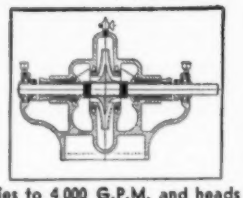

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auto racing and his exploits become a legend in racing history, but it was, and it did.

That "busy" day began for "Wibb" Shaw months, perhaps even years before, for as a small boy he had haunted the race track, sneaking in when possible to watch the drivers, and to learn the tricks of the masters, Barney Oldfield, "Howdy" Wilcox, and Eddie Rickenbacker, among others.

By 1931 Wilbur Shaw was a well-known driver in his own right and was scheduled to race the Auggie Dusenberg entry that year. Dusenberg's entry was quite a departure from the usual design, it being an extremely small car, with a super-charged high-speed motor. And with the beginning of that car, really began Shaw's "busy day."

To hear Shaw tell the story, as he did at the dinner that night at Purdue, "everything went wrong from the start." To begin with, work on the car didn't get under way until January. Then Dusenberg and Shaw ran out of money before the car was finished; with borrowed money the "job" was completed but it had more "bugs" in it than a can of Flit could take care of; and it was only a few days before final qualifying day that the car got on the track.

Even then the "bugs" continued to show up and the last day for qualifying came before it was ready for a qualifying trial. At last Shaw and his mechanic, "Terry," were rolling. With the engine turning up 3500 rpm. and the supercharger ten times that fast, the car made such a racket that Shaw hardly heard the "click" when the crank-shaft broke, turned sideways and neatly sliced the engine block in two, spilling parts and pieces for the full two and one-half miles of the brick oval track.

It was a dejected Shaw who sat in the garage, a few hours later, musing on the "fickle finger of fate," as Jack Benny would say, and scarcely hearing a voice above him say, "How would you like to drive for me?" His mind was playing him tricks; he thought he heard someone say, "How would you like to drive for me?"—That couldn't be. Qualifying day was over and all cars and drivers had qualified, there was no car—he couldn't qualify. Shaw looked up to see what ghost was haunting him.

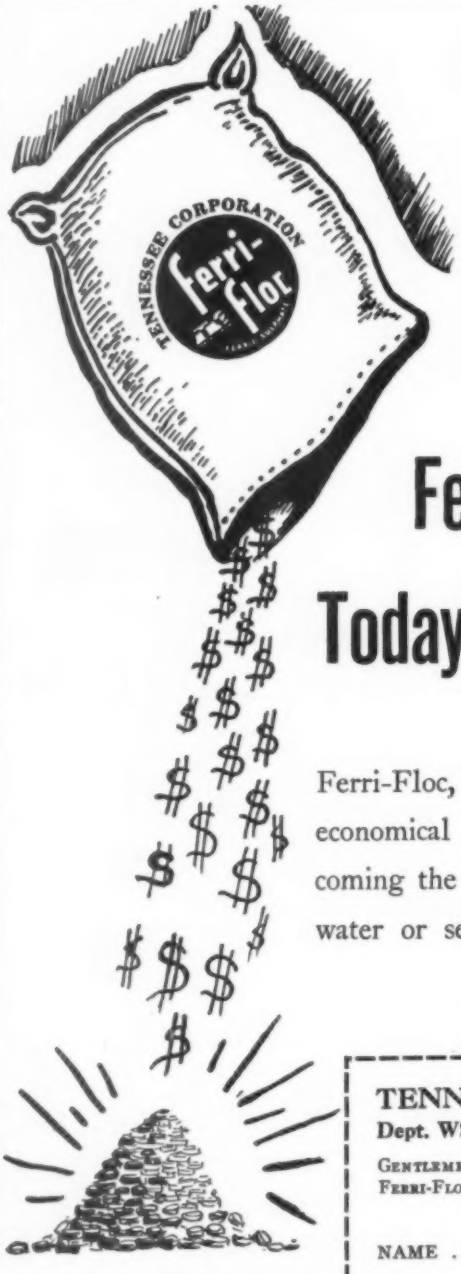
Fred Dusenberg, Auggie's brother, repeated his question, "How would you like to drive one of my cars, Wibb?" Fred Dusenberg had two identical cars entered, and one of the drivers "wasn't in a hurry." And if a fellow isn't in a hurry on the race track, there are plenty of others out there who are—so it was arranged that Shaw would drive one of the cars, No. 32, while Gleason drove No. 33.

For one reason or another, Shaw didn't have the opportunity to try out, before the day of the race, the car he was to drive, and even then he couldn't start the race as the rule says the qualifying driver must start. So the qualifying driver crossed the starting line drove into the pit, jumped out, and Shaw jumped in—and promptly sank out of sight.

Whereas, the Auggie Dusenberg car had been small, the Fred Dusenberg "job" was not only big, with a big, slow motor, but it was built for a big man to drive, and Shaw is anything but a big man. Only by sitting on one "cheek" could he reach the accelerator, and only by poking one eye out the side could he see the track before him. "But that," said Shaw, "was alright, for with only one eye to see what was in front of you, you could only get half as scared."

After a couple of laps to get the feel of the car, Shaw began to bear down on the pedal, but the accelerator was down to the floor-board and the big crate wouldn't run. Compared to the supercharged job, the slower motor made no noise at all—it couldn't be going very fast, and when Shaw passed the pit and saw Fred Dusenberg give him the O.K. sign, he thought, "This guy's sure easily pleased to have a wagon coasting along like this box car."

But it wasn't coasting. In the next few laps, Shaw noticed that he had passed a few cars and was actually leading the field. He didn't know how fast he was going; of course he could look at the tachometer on the dash board and see how fast the engine was turning, then calculate from the gear ratio of the drive how fast the wheels were turning, and from the



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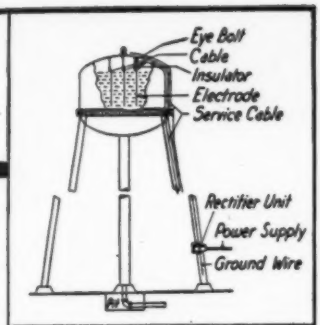

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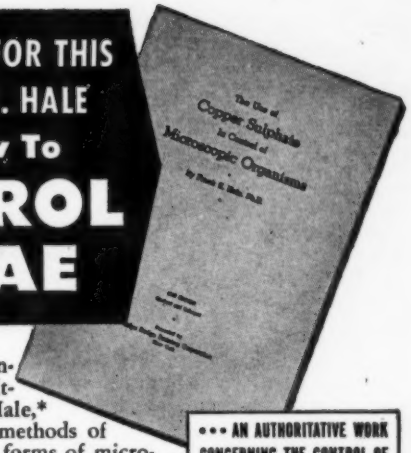

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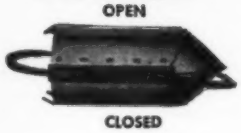

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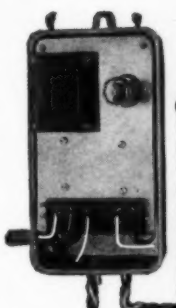

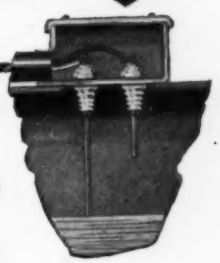

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diameter of the wheels, how many miles per hour he was going. By that time, however, he would have been another lap around the track, and after all it didn't matter. The main thing was to pass and lap those cars ahead of him.

A few laps later, Shaw came into the back stretch, and there ahead of him were four cars, radiator to tail. An extra push on the accelerator and he inched up until he was abreast of the lead car. They were approaching the north turn. If Shaw could just hold that accelerator down for a fraction of a second after the lead car slacked off, he would jump into the lead as he hit the turn, and then he too could slack off.

In order to carry out this plan, Shaw was watching the right front wheel of the other driver, waiting for the tell-tale shift in their respective positions. But the other driver didn't slack off until they hit the turn. Too late! Shaw couldn't make it then, and the car began to spin, and shudder, with that terrible squeal of skidding tires. As the other cars flashed by, No. 32 headed toward the wall, and Shaw and his mechanic "went down into the basement," which is to say that they shrank as far into the seat as possible, while the car sailed over the wall, landed on a string of telephone wires, taking them and the pole to the ground.

Somewhat dazedly, Shaw climbed out of a pile of junk, worth about $32. A few tenths of a minute before it had been a car worth a thousand times that much. Except for a number of brush burns and an egg on his head, Shaw was unhurt, but the mechanic was cut and bleeding.

The ambulance ride to the hospital, inside the track, was more frightening than the plunge over the wall, and the fire of tincture of iodine on raw brush burns was more painful than a dozen broken bones. To make matters worse, the hospital attendants had slit one leg of Shaw's new trousers, and as he walked back to the pit, with his trouser leg flapping in the wind, he was about as low as he had been on qualifying day.

Waving to his wife that he was O.K. Shaw entered the pit and somewhat dazedly heard a familiar voice say, "How'd you like to drive my other car?" Thus it was, that a few minutes later, Gleason was waved into the pit, jumped out of No. 33 to make room for Shaw to jump in—and promptly sink out of sight, for this car was identical with No. 32.

Well, it was the same story over again, one eye over the side, leg stretched clear out to reach the accelerator, steering wheel too big, and the sensation of going much too slow, but after a few laps the realization that he was again passing a few cars.

"It couldn't happen," said Shaw, "but it did. As I rounded the south turn into the back stretch, there ahead of me were these same four cars, radiator to tail, just like a bunch of Sunday drivers. As I crawled past the fourth, the third, and the second car, the look on the faces of the mechanics and drivers was real amazement. They were seeing things, or thought they were. Less than an hour ago, Wibb Shaw had passed them in the same car at the same place, and yet he had gone over the wall. (Remember the cars were identical except for the numbers). When I came even with the lead car, he took one look at me and promptly slacked off speed. He wasn't going through that dance again with Wilbur Shaw."

By that time Shaw was into the turn and again he was too late in slacking off. The car began to dance, then to slither, then to head for the wall at the same place the other one had taken off. Shaw and the mechanic "went down into the basement" again and waited at least five or six hundredths of a minute. Nothing happened, and Shaw poked one eye out again to see that the car was running parallel to the wall and about an inch from it. So he stepped on the gas, and was away, and leading the other four cars.

A hundred miles or so later, with fifth place safely in the bag and but 5 miles to go, Shaw turned No. 33 over to Gleason to finish the race. That evening, while sitting in the garage, congratulating himself on having won some money (mostly lap prizes) Shaw was unexpectedly greeted by a couple of the mechanics who had been in two of the cars he had passed at the turn. I say unexpectedly because of the greetings rather than the greeters.

Most matter-of-factly, just as though he were talking about a chance meeting

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at Monument Circle, one of them said, "I saw you at the north turn, a couple of times, today, and you almost didn't make it that second time, did you?"

The other mechanic, Terry, the Irishman who had been with Shaw during the qualifying trial, and who had been riding in the lead car of those four cars both times, had been celebrating somewhat and his comment was slightly thick but nonetheless succinct. Knowing that Shaw, who is not a Catholic, had been wearing a St. Christopher's Medal, Terry said, "Look, 'Wibb,' it was all right for you to lean on St. Christopher, that first time around, but considering that you're not one of his boys, don't you think that was a little too much to ask him to do it twice?"

"Wibb" Shaw has seen other busy days since, on three of which he won the annual race, and on one of which he had another accident in which he broke his back. This year Wilbur Shaw will not race, but as president and general manager of the Indianapolis Speedway, "Wibb" Shaw will again be a big factor in the success of the 500-mile Classic.

If you ever get a chance to hear him tell this story in person, don't miss it. V.T.Y. Dad." (G.E.S.)

THE SPILLWAY

[Overflow from the main section]

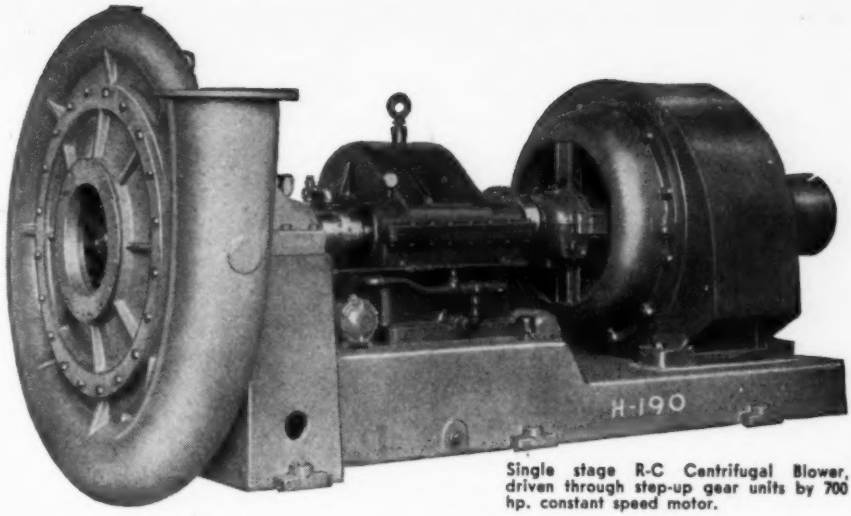
Two N. Y. State Sew. Wks. Sections Have Joint Meeting

On Sept. 21, at the City Hall of Canandaigua, N. Y., the Western Section and Genesee Valley Section of the N. Y. State Sew. Wks. Assn. held a joint meeting.

In the morning session, Wm. G. Kudefz, Gen. Mgr. Buffalo Office, Mine Safety Appliance Co., gave a talk on "General Safety," a motion picture was shown on "Operation of Sewage Treatment Plant," and a Round Table Discussion was held.

The afternoon session included a talk by Roland G. McDonald on "Sewage Disposal in the European Theatres," the film on "Clean Waters" and an inspection trip to the Veterans Hospital Treatment Plant.

These one day sectional sewage operators' meetings not only have proved popular with the small plant operators as well as the large ones, but bring to the operator a service that state and national meetings often cannot.



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Every revolution of the twin impellers in R-C Rotary Positive Displacement Blowers delivers a predetermined quantity of air, regardless of varying pressure.

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Where Centrifugal type blowers offer advantages, you'll find R-C units ready to serve you with fine performance given by excellent modern design.

You'll get the exact results you want when you turn over your aeration or agitation jobs to Roots-Connersville Centrifugal or Rotary Positive Displacement Blowers.

Want extreme purity? Air comes from R-C Blowers as clean as it goes in, because there's no internal lubrication.

Is constant volume or constant pressure important? You'll get the characteristics that fit your requirements.

Does operating cost count? You'll like the low power cost per cubic foot which is a basic advantage of R-C Blowers.

All these benefits come from R-C *dual-ability*, which provides either Centrifugal or Rotary Positive Blowers, with simple, sturdy construction that will give you long years of profitable operation.

Ask our engineers to help you with aeration or agitation problems. No obligation, of course.

ROOTS-CONNERSVILLE BLOWER CORP.

One of the Dresser Industries

610 Mount Avenue, Connersville, Indiana

Blowers for Every Need

Roots CONNERSVILLE SINCE 1854

ROTARY AERATING BLOWERS

ROTARY POSITIVE AND CENTRIFUGAL BLOWERS • EXHAUSTERS • BOOSTERS
LIQUID AND VACUUM PUMPS • METERS • INERT GAS GENERATORS

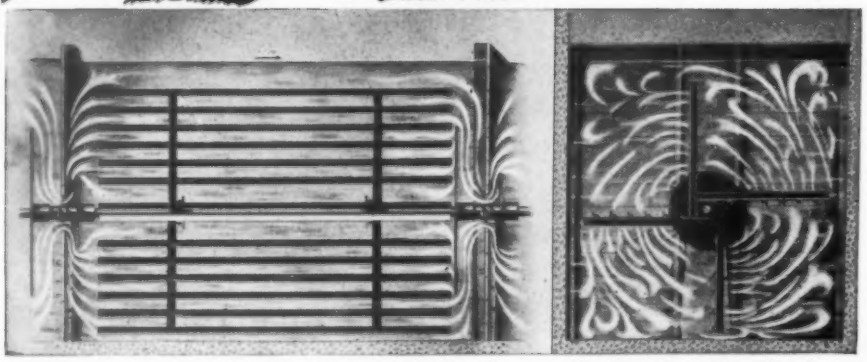
Indiana Sectional Water Works Meetings

The Indiana Section of the AWWA is another organization that believes in taking the conventions to the "small fellow" who can't get away to attend a larger state or national meeting. This year the twelfth annual district meetings of the water works operators were held in that state.

Cooperating in the presentation of these one day meetings were the Indiana State Board of Health, Purdue University, and the Indiana Section, AWWA. The meetings were held successively on Sept. 18, 19, 24, 25 and 26 at Rochester, Auburn, McCormick's Creek State Park, Jasper and Greensburg. Thus the northwest, northeast, west central, southwest, and southeast sections of the state were covered.

The program was practically the same at each meeting, consisting of the following features: "Meter Testing on Low Flows," by John L. Ford, Ford Meter Box Co., Wabash, Ind.; "Experiences in Water Supply Overseas" by various engineers with such experience; "Progress of Ground Water Survey," by Fred H. Klaer, U. S. Geol. Survey; "Presentation of the John N. Hurty Service Awards"; "Installing Cast Iron Pipe," a movie by the Cast Iron Pipe Research Assn.; "Regulations Governing Certification of Water Plant Operators in Indiana," by B. A. Poole, Director of the Bureau of Sanitary Engineering, State Board of Health; "Protective Maintenance," by Don E. Bloodgood, Prof. of Sanitary Engr., Purdue Univ., and "Service Pipe Problems," by W. E. Howland, Prof. of Civil Engineering, Purdue Univ.

The meetings convened at 9:30 a. m. and were adjourned in the late afternoon; a lunch was served at each and all sessions were well attended.



Typical section through Rex Floctrol, illustrating thorough dispersion of water and thorough mixing.

Head-end view of Floctrol section.

. . . The NEW Rex Floctrol

Rex Floctrol—the new, improved method of multi-stage flocculation—combines the desirable features of an efficient mixing mechanism with hydraulically correct tank construction. The Floctrol consists of a series of paddles mounted on a center shaft and parallel to the direction of flow. They provide exactly the right turbulence for maximum floc formation and, by decreasing this turbulence progressively, preserve this delicate maximum floc until the settling basin is reached.

The Floctrol Mixer assures:

1. Numerous, narrow paddle blades—greatest mixing and blending with least power.
2. Axis parallel to flow—all power used for mixing—none for turning over liquid.
3. Tapered mixing by zones—promotes large, readily settleable floc.
4. Uniform mixing throughout entire tank cross-section—minimizes short-circuiting currents.
5. Low first cost—Floctrol can be smaller than less efficient units.
6. Low horsepower—no wasted energy.
7. Low chemical consumption—thorough mixing assures positive reaction of all chemicals.

Investigate Floctrol for your plant. You'll find it quickly pays for itself. For all the facts, send for your copy of Catalog No. 46-3. Address Chain Belt Company, 1610 West Bruce Street, Milwaukee 4, Wisconsin.

REX SANITATION EQUIPMENT

Member of the Water Sewage Works Manufacturers Association, Inc.

CHAIN BELT COMPANY of MILWAUKEE

Water Treatment and Purification

(A Book Review)

The second edition of this book by William J. Ryan, published in Jan., 1946, carries a preface stating that the purpose of the book "is to make available to engineers, plant managers, students, and technical men in general a description . . . of the several purifications and other processes that are applied to water."

The second edition brings the book up to date since its first publication in 1937 and includes information on organic ion exchange, prevention of boiler embrittlement, new equipment for water softening, new developments in chlorine disinfection, and water stabilization.

The book devotes a large amount of space to boiler feed water, "because," says the author, "this department of water treatment is of interest to perhaps the largest group of engineers and because of the complexity of the subject."

Twelve chapters cover impurities, sedimentation and coagulation, filtration, analysis of water, lime-soda softening, ion exchange, boiler feed water, disinfection, tastes and odors, miscellaneous treatment, and corrosion prevention. The Appendix contains conversion factors, formulas, principal molecular reaction in water treatment, etc. The book is amply illustrated with 66 diagrams and pictures of modern equipment, particularly for industrial water treatment.

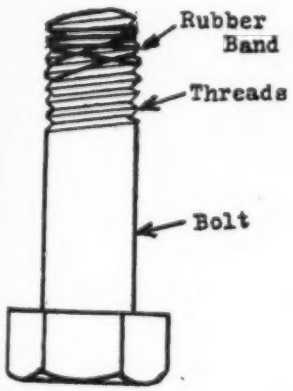
A selected bibliography appears at the end of each chapter, but only a half dozen or so of the references are dated 1940 or later.

It is not the fault of the author that this edition was printed just prior to the issuance of the 1946 U. S. P. H. S. Drinking Water Standards, thereby making obsolete the 1942 standards quoted in the book. Unfortunate, too, is the fact that much of the chapter on analysis of water is based on material from the 8th and even the 6th editions of Standard Methods for the Examination of Water and Sewage; unfortunate but not the author's fault since the 9th edition is only now in press.

The author, William J. Ryan, now associated with the Water Service Corp., was at one time associated with the Permutit Co. and is a member of A. S. M. E. and A. W. W. A. The book contains 270 pages, is published by McGraw-Hill Book Co., Inc., and retails for $2.75. (G. E. S.)

How to Lock a Nut with a Rubber Band*

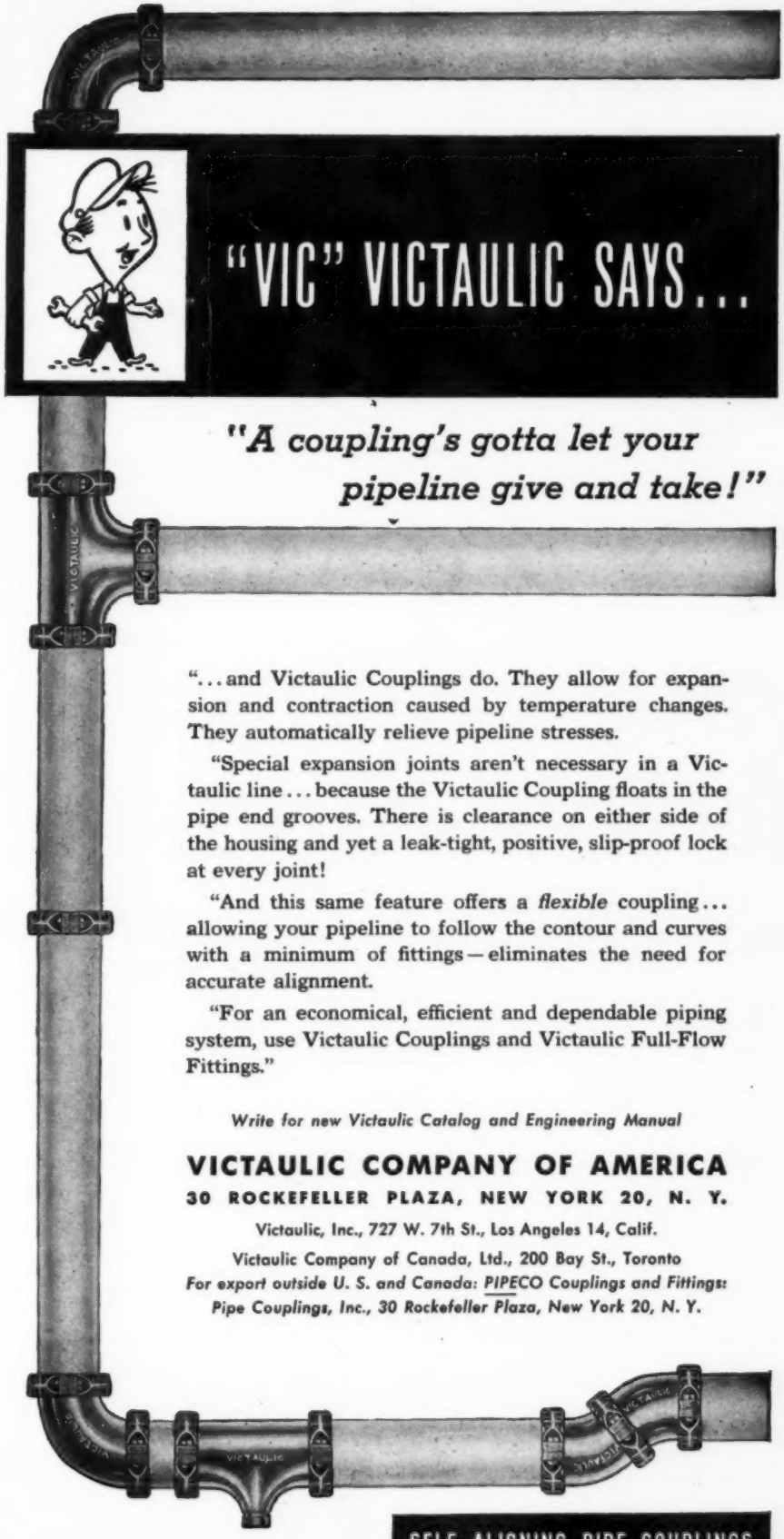
An ordinary rubber band can be converted into an effective lock nut by following the method indicated in the accompanying sketch.



Wrap the rubber band tightly around the threads of the bolt by stretching the rubber while wrapping. The band being endless it will stay in place nicely.

Then turn the nut on. The rubber band will prevent the bolt from working loose much more effectively than will many so-called nut holding devices. The rubber band will very likely be "chewed up" by the threads when screwed in place, but that will usually make no difference because the "particles" of rubber remaining between the nut and bolt continue to be elastic even as individual pieces and they will all aid in doing the holding.

*Contributed by W. F. Schaphorst, M.E., Newark, N. J.



"...and Victaulic Couplings do. They allow for expansion and contraction caused by temperature changes. They automatically relieve pipeline stresses.

"Special expansion joints aren't necessary in a Victaulic line... because the Victaulic Coupling floats in the pipe end grooves. There is clearance on either side of the housing and yet a leak-tight, positive, slip-proof lock at every joint!

"And this same feature offers a *flexible* coupling... allowing your pipeline to follow the contour and curves with a minimum of fittings—eliminates the need for accurate alignment.

"For an economical, efficient and dependable piping system, use Victaulic Couplings and Victaulic Full-Flow Fittings."

Write for new Victaulic Catalog and Engineering Manual

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30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Victaulic, Inc., 727 W. 7th St., Los Angeles 14, Calif.

Victaulic Company of Canada, Ltd., 200 Bay St., Toronto

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Have you considered Victaulic for your piping requirements?
Sizes—¾" through 60"

SELF-ALIGNING PIPE COUPLINGS
VICTAULIC
EFFICIENT FULL-FLOW FITTINGS

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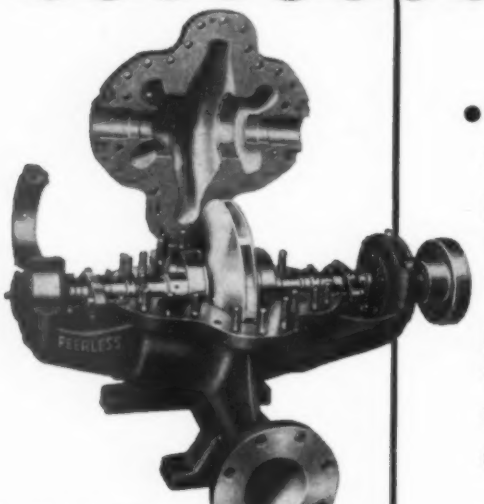
PEERLESS
(FORMERLY DAYTON-DOWD)
Horizontal Centrifugal PUMPS

General Service
Continuous Duty
A Wide Range of Sizes and Capacities
Up to 60,000 G.P.M.



PEERLESS TYPE "A" SPLIT CASE

Capacities: up to 60,000 g.p.m.
Single Stage—Double Suction.
Embodies most advanced hydraulic design and efficiencies.
Ball Bearing Type.

- Effectively used in all types of industries where high-grade pumping is needed under stress of pressures and high temperatures. Peerless Centrifugal pumps can be furnished in other than standard specification metals and dimensions for special pumping problems.

Learn of the many advantages gained when you pump with a Peerless. Write Today.

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ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

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Ripley Discovers Waterman Hyman

HY HYMAN
PRESIDENT OF ANGLERS, INC.
HAS MADE 2,260 FISHING TRIPS
AND CAUGHT MORE THAN 1000 SAILFISH
BUT-RETURNED THEM ALL TO THE SEA
EXCEPT ONE - A SPECIMEN 6 INCHES LONG
Palm Beach, Fla.
MR. RAMWATER MARRIED MISS CLOUDBURST AND THEY LIVE ON DUCK STREET IN STILLWATER, MINNESOTA

The above Ripley "Believe-it-or-Not" story and sketch features the angling ability of waterman H. H. Hyman of Miami, Fla.

"Hy" Hyman, who is Division Manager for Florida Power & Light is also Vice-Pres. of the Consumers' Water Co., of Coral Gables, Fla. Until recently he was a member of the A.W.W.A. Board, representing the Florida section.

For some years "Hy" has been president of Anglers, Inc. of America, which honor is apparently the result of his record as a fisherman—and as a "go-getter."

(The accompanying sketch is reproduced through courtesy of King Features Syndicate, Inc.).

Inter-Association Group Formed to Combat Soil Corrosion

It may be of interest to many persons in the field of sanitary engineering, particularly those concerned with pipes and pipe lines, to learn that several organizations have held a joint meeting to study and consider the problem of soil corrosion and cathodic protection.

Working under the title of the Correlating Committee on Cathodic Protection, the group, composed of representatives of the American Assn. of Railroads, the American Gas Assn., the American Petroleum Institute, the American Water Works Assn., the Bell System, Western Union Telegraph Co., and the National Assn. of Corrosion Engineers, proposed to undertake a program of education and assistance to be accomplished through the preparation of general and technical bulletins.

Provisional bulletins are: General Information on Cathodic Protection.

Notification Procedure, Cathodic Protection Practices, and Joint Cathodic Protection Installations. The Correlating Committee proposes to work in harmony with the Metropolitan Electrolysis Committees.

MANUFACTURERS' and EQUIPMENT NEWS

Permutit Co. Acquires Simplex Valve and Meter

The Permutit Co., manufacturers of water conditioning equipment, industrial ion exchangers and power plant specialties, has acquired the Simplex Valve and Meter Co. of Philadelphia, according to an announcement by H. W. Foulds, Permutit's president. Mr. Foulds succeeds W. H. Roth as president of the newly acquired Simplex Co., while Mr. Roth becomes Chairman of the Simplex Board.

The Simplex Co., prominent in the design and manufacture of equipment for the control and regulation of fluid flow, will continue to operate under its own name, according to the announcement.

"Many advantages are to be derived from the close cooperation of the engineering, research and sales organizations of the two companies," Mr. Foulds said, "and these will accrue to Permutit, which has been the largest buyer of Simplex products."

During the war, The Permutit Co. built water treatment plants for many essential war industries and the armed forces. Permutit also developed a pocket-sized chemical apparatus to convert salt water to a drinkable product, which was adopted by the Army and Navy Air Forces for use by fliers forced down at sea.

Geared Pipe Threader

The Ridge Tool Co., Elyria, Ohio, has announced the production of a new 4P geared pipe threader. Two innovations of this device are a quick-setting workholder and a new balanced loop handle. The former device affords an advantage in set-

Left: Floc with alum alone. Right: Floc with alum plus activated silica sol.

PIN-POINT? OR SNOW-STORM FLOC—the larger and heavier floc which enmeshes the suspended solids better, and settles more rapidly!

Get this increased floc size and improved clarity by using the activated silica sol coagulant aid made with sodium silicate. Besides clearer water, you can count also on longer filter runs and increased capacity.

Study now the benefits from the use of N-Sol Processes (activated silica sol) in your water supplies. For the correct results, send for fresh samples of N Brand with jar test directions.

Four ways of converting N Brand Sodium Silicate into useful coagulant silica sols to fit your conditions:

N-Sol-A*—N Brand reacted with ammonium sulfate. Used where chloramine sterilization is desired.

N-Sol-B—N Brand reacted with alum. Used with any sterilization procedure. (U. S. Pat. 2,310,009).

Baylis Sol—N Brand Silicate reacted with sulphuric acid. Used with any sterilization procedure. (U. S. Pat. 2,217,466).

N-Sol-D—N Brand reacted with sodium bicarbonate. Used with any sterilization procedure.

* Patent Applied For.

N-SOL PROCESSES FOR WATER COAGULATION

Developed and Patented by

Philadelphia Quartz Company

Available under license without charge • Philadelphia 6

ting the threader exactly to size before being placed on the pipe. Once on the pipe, only one screw needs to be tightened to hold it securely. All bothersome bushings have been eliminated. The balanced loop handles prevent the gear case from slipping or tipping and make it easy to pick up and put straight on the pipe. The gear is fully enclosed, packed in grease, and protected from dirt and wear. Ratchet handle is provided with each 4P and a special RIDGID design universal drive shaft is available for power drive. Further information on this new 4P geared pipe threader may be obtained from the Ridge Tool Co., Elyria, O.

Automatic Hypochlorinator

Wilson Chemical Feeders, Inc., of Buffalo, N. Y., has announced a Type SP Automatic Hypochlorinator. This is a positive displacement proportioning feeder operating on the Venturi principle. The outstanding feature of the Type SP Automatic Hypochlorinator is its applicability to any water supply, either gravity or pumped, up to 250,000 gpd., or swimming pools up to one and a half million gallons capacity. It feeds chlorine in proportion to the flow or consumption of water, the feed is visible and the dosage adjustable. The equipment is actuated by the flow of water in the main but does not waste any water, and will continue to chlorinate although completely submerged in flood waters. It functions with equal efficiency on any pressure from five to 150 lbs. No power is required and no moving parts, gears, belts, or lubrication are necessary.

Further information on this new Wilson Hypochlorinator Type SP may be obtained by writing for Bulletin 1446 to the Wilson Chemical Feeders, Inc., 205 Clinton St., Buffalo 5, N. Y.

SOLVAY
LIQUID
CHLORINE
Here's the way to keep water SAFE every second of every day!
SOLVAY Liquid Chlorine is the proven way of insuring the safety of every drop of water you deliver every second of the day. Be sure of the safety of your water supply... protect it with SOLVAY Liquid Chlorine treatment. You cannot afford to neglect water safety for a single second. Quick delivery is available from three strategic manufacturing plants—Solvay, N.Y., Hopewell, Va., Baton Rouge, La.
SOLVAY SALES CORPORATION
Alkalies and Chemical Products Manufactured by The Solvay Process Company
40 Rector Street
New York 6, N. Y.

Walker Process Equipment New Name in Water and Sewage Field

Walker Process Equipment Co., a new name in the water and sewage field, has been formed as a corporation with headquarters in Aurora, Ill. President and organizer of the new concern is J. D. Walker, formerly Vice President and Director of Engineering of the American Well Works.

J. D. Walker

Already in active operation, the new company is supplying equipment for water treatment, liquid processes, liquid conditioning, and sewage and waste treatment for industrial and municipal users.

Associated with Mr. Walker in the new enterprise are A. W. Nelson, Vice Pres., Douglas E. Drier, Chester B. Obma, John R. Sperry, Vice Pres., and Frank Voris, Secy-Treas., all men with experience in the field of water and sewage treatment. Offices are located at 33 Hoyt Place, Aurora, Ill.

Coltart Returns to Link-Belt

Captain Rodney F. Coltart, recently released from the U. S. Army Sanitary Corps, has returned to the Link-Belt Co. as Engineer for the Sanitary Engineering Division in the eastern sales territory.

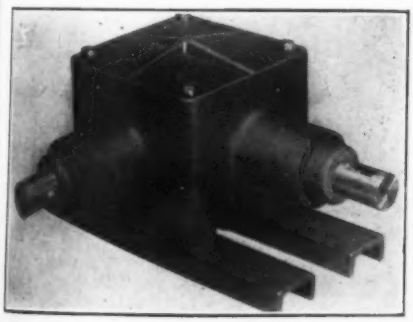
R. F. Coltart

During the war, Capt. Coltart was stationed at the Army Air Force Regional Station Hospital, Westover Field, Mass. "Rod" Coltart, as he is best known among the sanitary engineering profession, has his headquarters at the company's Philadelphia plant.

New Angle Gear Unit

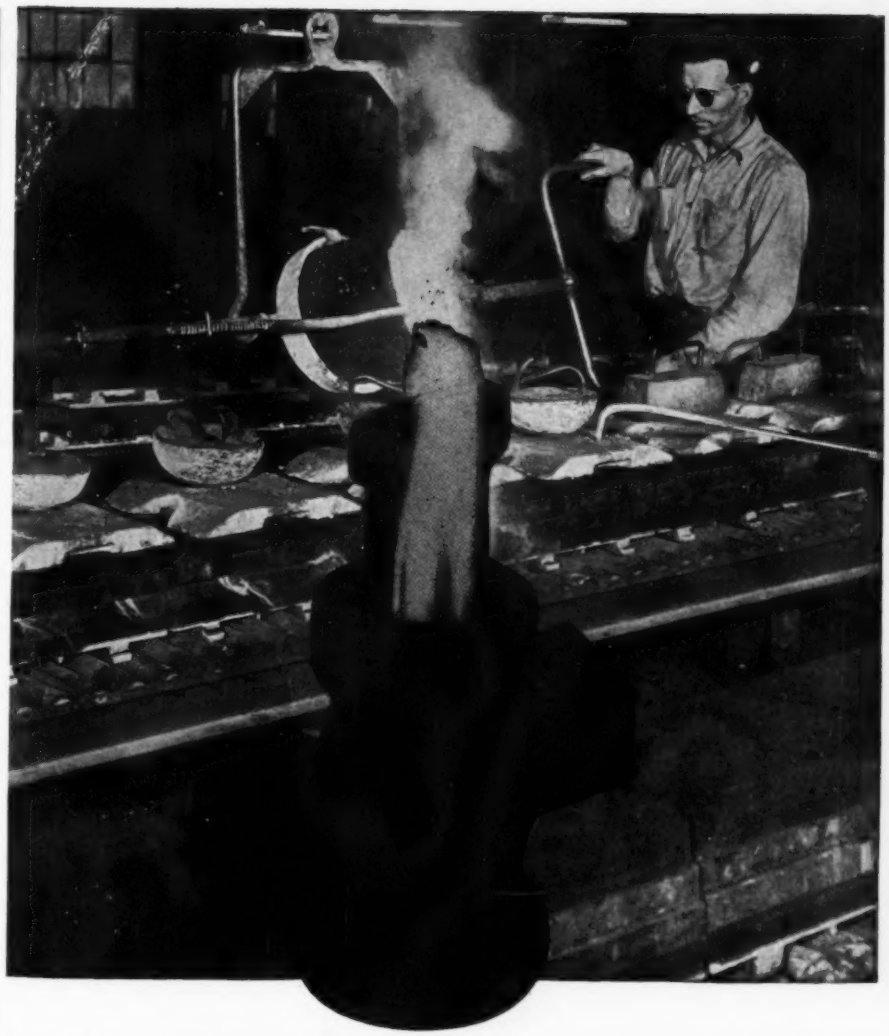
Payne Dean & Co. of Madison, Conn., has announced the development of a new angle gear unit, particularly for slow speed and high torque for intermittent operation, such as control of oven doors, shafting at right angles, valves, etc.

The gears are of straight bevel type, 1 to 1 ratio, and the steel shafts operate in grease lubricated bronze bearings. The machine may be used in any operating position and is weatherproof.



Two sizes are available with a capacity of 1,000 and 4,000 inch-pounds, and for five minute operation. The unit has no feet but is drilled at four points in the base and is usually bolted to common channel iron.

Further information on the new angle drive unit may be obtained from Payne Dean & Co., Madison, Conn.



Quality Castings ARE BUT ONE OF THE EXTRAS WHICH ACCOUNT for GLAUBER "LIFE-TIME" SERVICE

Glauber's reputation for providing the "extras" in ground key work—perfect interchangeable parts, waterproof bearings, full opening ways, life-time lubrication, etc., — is made stronger by the constant use of Red Brass Formula in their heavy body castings. The use of specification Red Brass assures a casting of uniform quality and long service. A complete line of Glauber waterworks fittings is once again available to meet your installation demands. Write today for quotations on your specific waterworks requirements.

K-1034 Illustrated. Inverted key curb stop. Loose tee handle, round way, inside iron pipe threads for iron pipe or lead flange attachment. Also available in Minneapolis, Indianapolis and Kansas City code.

THE Glauber BRASS MFG. CO., KINSMAN, OHIO
Division of H. B. SALTER MFG. CO., Marysville, Ohio

Glauber RED BRASS

L. F. Moran to Represent Hays Mfg. in New England

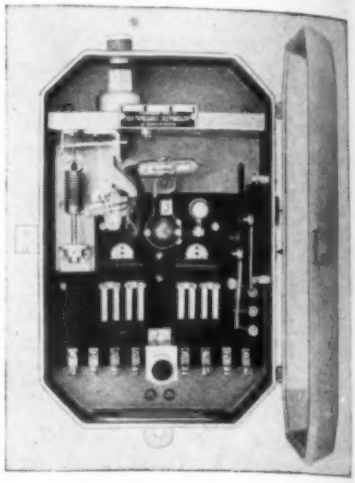
Announcement has been received from the Hayes Manufacturing Co. of Erie, Pa., that henceforth L. F. Moran of Worcester, Mass., will be sales representative for the company in the New England area.

Mr. Moran has lived for a number of years in New England and was formerly associated with the General Electric Co., engaged in various aspects of the manufacture, merchandising, and sale of electric appliances.

Automatic Pump Control

The Automatic Control Co. of St. Paul has produced a new unit to protect deep well and centrifugal pumps from running without water. Known as the Protectrol, this protective control device not only sounds an alarm if the water level drops to a point where water prime is lost, but it actually stops the pump. The unit may also be obtained without the alarm warning.

Mechanical failure, lowering of water table or any other cause of water not being discharged will stop the pump. The Protectrol is not a primary control device which may be used for automatically starting the pump. Rather it is used in conjunction with a primary control either automatic or manual. The Protectrol

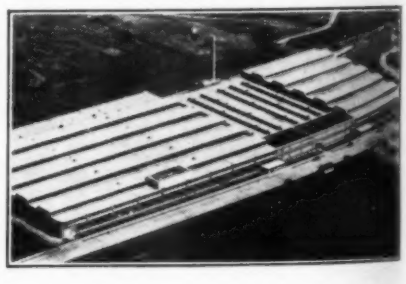


is inoperative unless the primary control has called the pump into action by pulling in the starter. Even with automatic control, once the Protectrol stops the pump, it locks it out until manually reset.

Further information, including directions for installation of this new unit which has been thoroughly field tested before introduction to the market, may be had by writing the Automatic Control Co., 1005 University Ave., St. Paul 4, Minn.

Chain Belt Buys Ordnance Plant

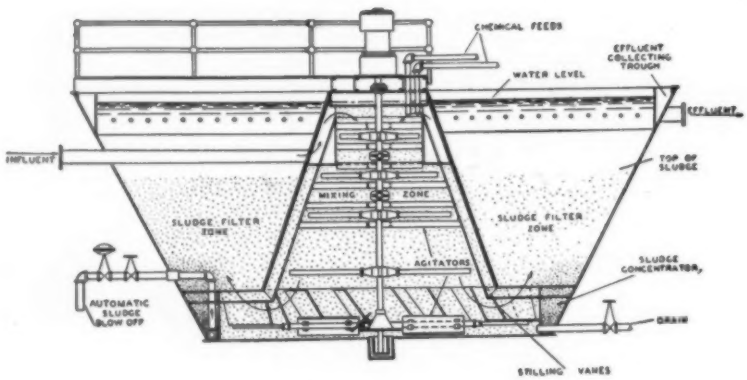
The Chain Belt Co. of Milwaukee has materially increased its plant capacity through the purchase of the heavy ordnance plant originally con-



structed for the Defense Plant Corporation in West Milwaukee. Originally constructed for the 4.7 anti-aircraft gun, the plant was later retooled for the production of the 155 mm. "Long Tom" and the 105 mm. howitzer.

Present plans call for the plant's use in the manufacture of chain belts and some construction machinery.

A new, more efficient means for removing impurities from municipal water supplies



PERMUTIT *(SPAULDING)* PRECIPITATOR

IN the Spaulding Precipitator, Permutit* has combined precipitation and separation in a single treatment step, so that water being treated flows clear from the top of the equipment.

The Vertical Precipitator, as shown schematically above, was the first development of this "sludge blanket" principle, which provides a sharp demarcation between sludge and clear effluent. Other designs are available.

Permutit Precipitators not only represent a more efficient means of cold lime treatment, but are more compact than older style methods. Permutit will be glad to cooperate with you and your consultants on any problem of producing a clear, soft, iron-free water. Many types of equipment are available, and more than 30 years' experience is at your service.

For full particulars write to The Permutit Company, Dept. W-10, 330 West 42nd Street, New York 18, N. Y., or Permutit Co. of Canada, Ltd., Montreal.

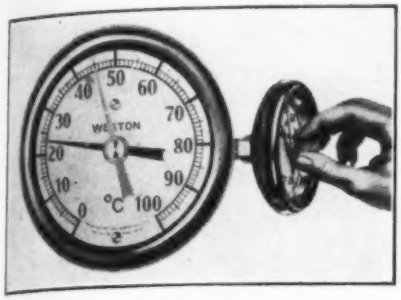
*Trademark Reg. U. S. Pat. Off.

PERMUTIT

WATER CONDITIONING HEADQUARTERS

Weston Max-Min Thermometer

An all metal thermometer called the Max-Min has been introduced by Weston Electrical Instr. Corp. Designed to indicate either the lowest or highest temperature reached, this new thermometer has an auxiliary red index, manually set on either the



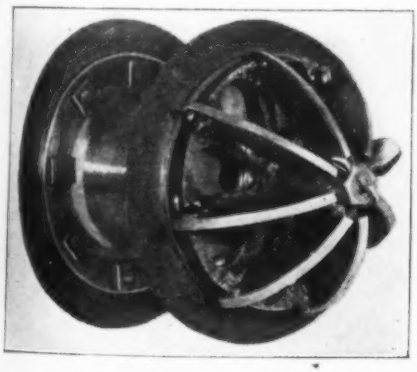
low side or high side of the pointer, depending on whether maximum or minimum temperature record is desired.

Available in two models, 221M and 222M, with scale diameters of three and five inches, the thermometer may be obtained with stem lengths from 2½ to 48 inches. It may be used on transformers, sterilizers, ovens, chemical equipment, on sludge lines that are being steamed to remove grease, heat exchangers, etc.

Complete information is available from Weston Electrical Instrument Corp., Newark, N. J.

The Reese Reamer

A mechanical tool for cleaning commercial, industrial, mine, marine, water or oil lines, the Reese Reamer, shown in the accompanying photograph, requires no cables or rods for its operation. The Reamer works under the pressure of the fluid in



the line, cutting away obstructions and cleaning the pipe in one operation.

The Reese Reamer will make turns up to 90 degrees and works equally well in perpendicular or horizontal lines. Because it moves with the liquid in the pipe line, it does a quick job and does not require long periods of outage. Sizes range from 2½ inch to 36 inch.

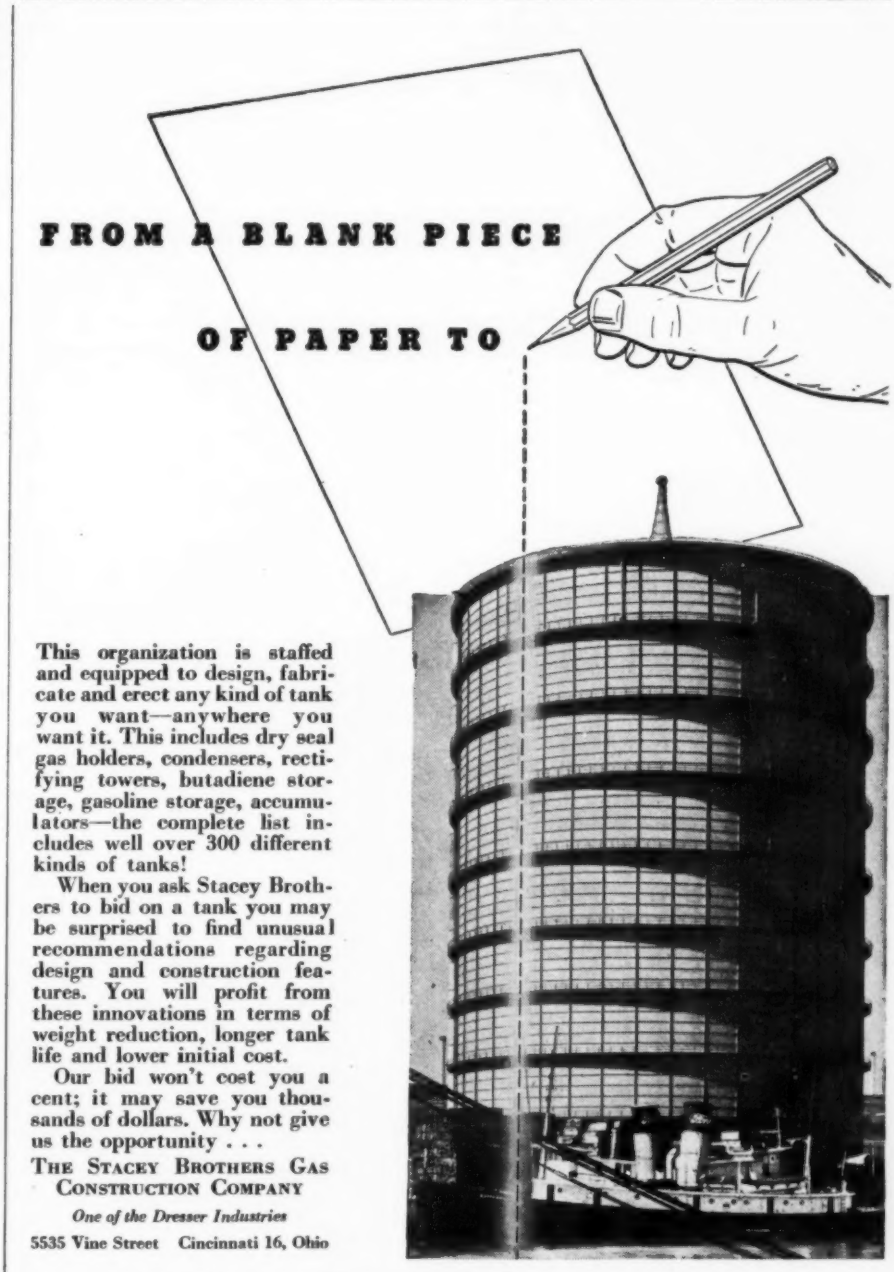
Further information may be obtained from the J. D. Reese Co., 1015 Chestnut St., Philadelphia 7, Pa.

A. U. Fox New Chairman of Mathieson Board

Election of Abijah U. Fox as Chairman of the Board of Directors of The Mathieson Alkali Works has been announced by George W. Dolan, president. Mr. Fox recently returned from Europe, where he served as Deputy Director, Finance Division, U. S. Military Government, Germany.

Prior to his War Department post, Mr. Fox was with the Treasury Department. He served as Deputy Director, Foreign Funds Control, and Director of the Office of Surplus Property.

After graduating from Rutgers University in 1926, Mr. Fox went to



This organization is staffed and equipped to design, fabricate and erect any kind of tank you want—anywhere you want it. This includes dry seal gas holders, condensers, rectifying towers, butadiene storage, gasoline storage, accumulators—the complete list includes well over 300 different kinds of tanks!

When you ask Stacey Brothers to bid on a tank you may be surprised to find unusual recommendations regarding design and construction features. You will profit from these innovations in terms of weight reduction, longer tank life and lower initial cost.

Our bid won't cost you a cent; it may save you thousands of dollars. Why not give us the opportunity . . .

THE STACEY BROTHERS GAS CONSTRUCTION COMPANY

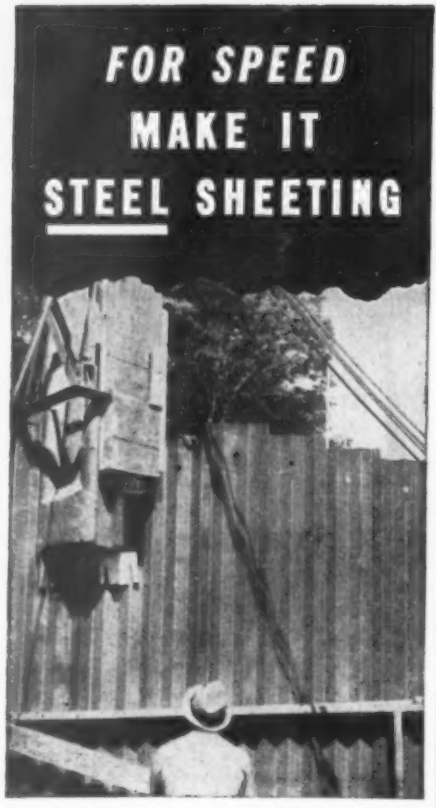
One of the Dresser Industries

5535 Vine Street Cincinnati 16, Ohio

Stacey Brothers

ALL-WELDED GAS HOLDERS

ANY PRACTICAL SIZE OR SHAPE OF TANK. This Stacey-Klonne type dry seal gas holder has a ten million cubic foot capacity. In this design a "piston", with a patented mechanical seal, moves up or down in the shell as gas volume increases or decreases.



Sheeting jobs, whether permanent or temporary, are done quickly and economically with ARMCO Steel Sheeting. Check these advantages:

SAFE STRENGTH . . . ARMCO Sheeting is corrugated to assure ample strength with light weight. This makes for easy handling and quick installation.

EASY TO DRIVE . . . Light weight and small displacement area simplify driving. Sections butt together or are held securely in place by interlocking joints that assure the right alignment and practical water-tightness.

LOW COST . . . Besides economy of installation ARMCO Sheeting is low in cost. You buy the exact weight you need. Repeated use of the sheeting makes job costs surprisingly low.

ARMCO Sheeting is nestable and requires comparatively little space for shipment and storage. Write for prices and information on how ARMCO Steel Sheeting can better do your job. Armco Drainage & Metal Products, Inc., and Associated Companies, 2435 Curtis Street, Middletown, Ohio.

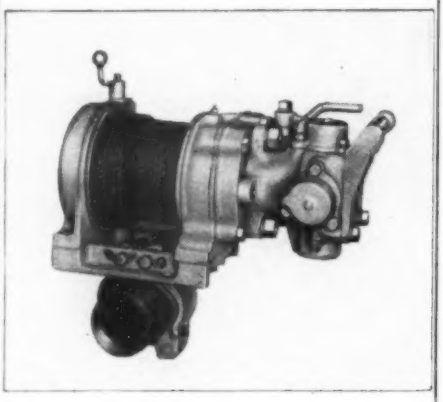
ARMCO

ARMCO STEEL SHEETING

Tokyo for the National City Bank and remained there for eight years as Assistant Manager. In 1934 he joined the security investments firm of Swann, Culbertson & Fritz, an affiliate of Hayden Stone & Co. As managing partner, Mr. Fox was at the main office in Shanghai until he returned to this country in 1941.

Air-Winch

The Sullivan Division of the Joy Manufacturing Co. has announced a new lightweight, air-powered hoist called the *Air-Winch*. Capable of lifting 500 lbs., yet weighing only 85 lbs., the Air-Winch has a rope capacity of 150 ft. of ¼ in. rope and is only 18 in. long, 9½ in. high, and 11 in. wide.



The Air-Winch is powered by a simple, four cylinder, reversible, piston-type air motor and can be used in many different ways on a construction job or in the plant.

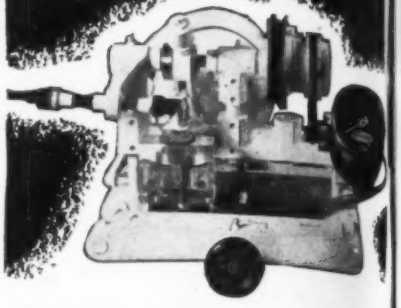
The Sullivan AW-80 Air-Winch is described in Bulletin No. 76-H, which may be obtained from the Sullivan Division, Joy Manufacturing Co., Michigan City, Ind.

Penn Salt Executives Receive Danish Medals

Leonard T. Beale, Pres. of Pennsylvania Salt, and Richard L. Davies, his assistant, have received from King Christian X of Denmark the King Christian X Medal of Liberation for their efforts in the Danish cause during the years of Nazi occupation.

The medals were bestowed for the work these men did in helping the Danish Colony of Greenland keep free from the Nazi yoke as well as helping the cause of Denmark in

WHEN YOU BUY
VAR-I-FEEDER
YOU BUY
Quality!



Quality in Design:

The experience of a decade in pioneering small chemical feeders, followed by three years of developing an improved device and studying hundreds of VAR-I-FEEDER installations now culminate in the present advanced VAR-I-FEEDER design.

Quality in Materials:

Torrington Needle Point Roller Bearings, Corbin Tachometers, Alemite Zerk Lube Fittings, Reeves Variable Pulleys . . . these are only a few of the quality component sub-assembly parts that go into VAR-I-FEEDER.

Quality in Production:

VAR-I-FEEDER is built in a complete, large, modern manufacturing plant by craftsmen who know their job. In Providence VAR-I-FEEDER has just moved into its new home, twice the size of the old one.

Remember VAR-I-FEEDER means hi-speed, Tachometer counted injections and easy change-of-feed. Just a turn of the handwheel regulates feed without interrupting processing.

• • •

Send for booklets VAR-I and No. 91

VAR-I-FEEDER

FOR ACCURATE CHEMICAL FEEDING
CHEMICAL WATER TREATMENT
CHLORINE DIOXIDE PROCESS
FOR TASTE AND ODOR CONTROL
HYPOCHLORINATION

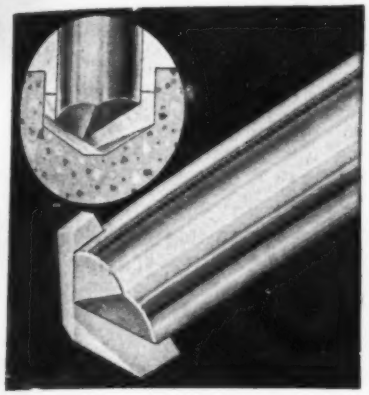
CHEMICAL FEEDERS DIVISION
MORSE BOULGER DESTRUCTOR COMPANY
NEW YORK 17, N. Y.
Room 1700B, 205 E. 42nd Street

PROVIDENCE OFFICE,
250 AUBURN ST., CRANSTON, R. I.
Representatives in all principal cities
Equipment Makers and Proportioning Engineers

America and throughout the world. Their interest in Greenland was the result of long association of Pennsalt with the Danish government since the company first began the importation of cryolite ore from Greenland in 1865.

Rotary Drills for Masonry

Kennametal, Inc., has announced the production of a line of Kennadrills for rotary drilling of concrete, brick, slate, marble, limestone, plaster, glazed tile, asbestos, and other non-metallic construction materials. These drills have tips of Kennametal, the cemented carbide that is harder than tool steel.



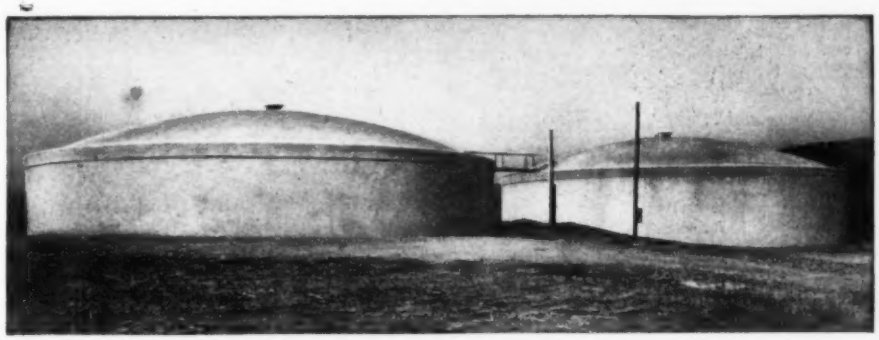
Any rotary type drill can be used to operate these drills which can be sharpened on a tool grinder using loosely bonded silicon carbide wheels. Nine different sizes are available up to one inch. Complete details are available in Leaflet 46-5, which may be obtained from Kennametal, Inc., Latrobe, Pa.

Pocket Stove Ideal for Small Laboratory

Do you remember the "Ernie Pyle Stove," so-called because Pyle frequently wrote about the Coleman Military Stove, a pocket size stove little larger than a quart food can. According to the *Aluminum News Letter* of Alcoa, this famous stove is again being produced by The Coleman Co. of Wichita, Kan., this time for civilian use. This little stove, which holds a pint of fuel and will burn any kind of gasoline, burns for three hours with an almost invisible flame that puts out 5000 Btu. per hour.

It isn't only that we know a number of our readers might find this a useful item for fishing and camping trips or evening picnics, but this item, which was called during the war "the greatest piece of non-fighting equipment developed," should

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.



PRE-STRESSED "GUNITE" TANKS

Above are shown two 80' diameter 750,000 gallon prestressed "GUNITE" water storage tanks with "GUNITE" dome roofs. We built these tanks in 1943 for the Borough of Schuylkill Haven, Penna.

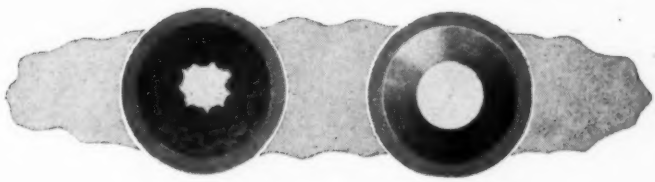
Prestressed "GUNITE" produces a water storage tank which is bottle tight and maintenance free. They may be built either at ground level, completely underground with earth covering over the dome roof, or may be in the form of stand-pipes or elevated tanks.

Our experience in this field includes scores of tanks and silos of many types ranging up to two and one-half million gallons capacity.

Our 72 page Bulletin C2300 describes this method of construction fully and also other uses of "GUNITE."

Write for your free copy of Bulletin C2300 today.

MANUFACTURERS OF THE "CEMENT GUN"



Before Cleaning After Cleaning

The Trade Mark of a Nation-Wide Organization

From Washington, D. C., to the Pacific, North, South, East and West, National Water Main Cleaning experts stand ready to serve you —guaranteeing to restore your mains to 95% of original capacity.

For as many as 40 years—longer than most water works men have been engaged in their professional work, National Water Main Cleaning Company has been building up an organization of engineers trained in the art of rehabilitating water lines.

This "95% performance" is now accomplished more quickly and with less disturbance to your normal operation than was ever possible before.

To put your water distribution system into first class condition for maximum service get in touch with our nearest office.

The National Water Main Cleaning Co.

50 Church St. **Branches:** **New York 7**

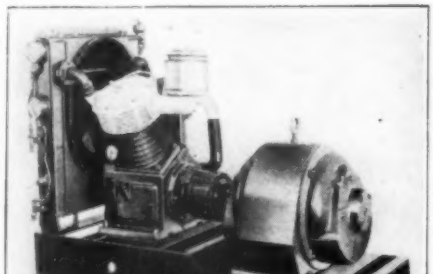
115 Peterboro St., Boston 15, Mass.
P. O. Box 749, Mayaguez, Puerto Rico
7103 Dale Ave., St. Louis 17, Mo.
3707 Madison St., Kansas City 2, Mo.
3812 Castellar St., Omaha 5, Neb.
P. O. Box 683, Jacksonville 1, Fla.
205 West Wacker Dr., Chicago 6, Ill.
501 Howard St., San Francisco, Cal.
2028 Union Ave., Montreal, Can.
576 Wall Street, Winnipeg, Canada
519 Farnsworth Bldg., Memphis 3, Tenn.

find a very real use for small water and sewage works laboratories. It should be excellent for field work and with mobile laboratories. We can remember many a time when a small stove of this type would have been a great help in stream pollution field studies, not only to warm the coffee, but to melt agar for plate counts, to sterilize equipment, bottles, tubes, etc. We can think of as many uses in the small laboratory, and this type of stove might well take the place of a hot plate for some work in a larger laboratory.

We suggest that you write the Coleman Co., Inc., Wichita, Kan., for further information.

Departmental Air Compressors

Davey Compressor Co. has begun the manufacture of a line of air compressors known as "Departmental" compressors. These new units are available in 60, 105, 160, 210 and 315



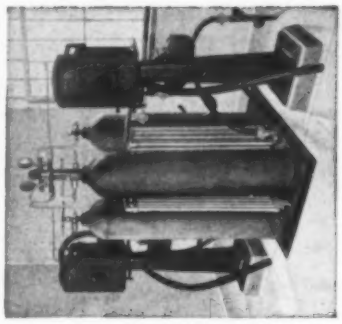
cfm. sizes. These units are designed to furnish air for any department in a factory but are also hooked into a header connecting all units. This departmental system has great advantages in increased efficiency. These compact units may also be used separately and could be used as a portable unit in any location where electric power is available.

These new compressor units are obtainable from the Davey Compressor Co., Kent, Ohio.

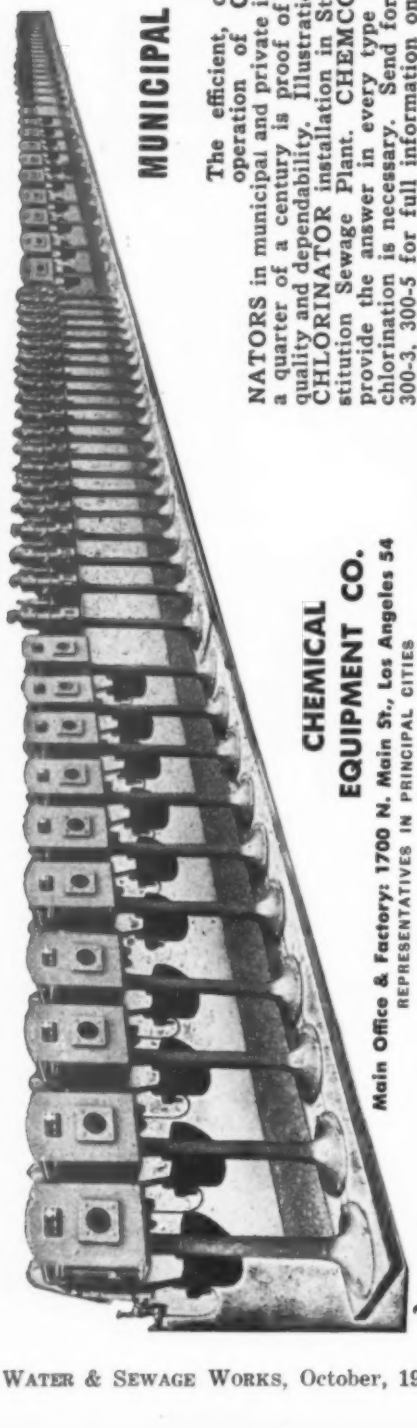
New Commercial Standard for Mineral Wool Insulation

The National Bureau of Standards has released a new Commercial Standard CS-131-46 on "Industrial Mineral Wool Products, All Types—Testing and Reporting." This new standard permits engineers to specify the basis for mineral wool insulation to be used in connection with construction. The new standard may be obtained from the Industrial Mineral Wool Institute, 441 Lexington Ave., New York 17, N. Y.

CHEMCO CHLORINATORS
for
MUNICIPAL INSTALLATIONS



The efficient, continuous, automatic operation of CHEMCO CHLORINATORS in municipal and private installations for nearly a quarter of a century is proof of their extremely high quality and dependability. Illustration shows a CHEMCO CHLORINATOR installation in State of New York Institution Sewage Plant. CHEMCO CHLORINATORS provide the answer in every type of installation where chlorination is necessary. Send for bulletins Nos. 300-1, 300-3, 300-5 for full information on exclusive CHEMCO features.



CHEMICAL EQUIPMENT CO.
Main Office & Factory: 1700 N. Main St., Los Angeles 54
REPRESENTATIVES IN PRINCIPAL CITIES

How to join more bell and spigot cast iron water mains per hour ...at less cost

Haymanite JOINTING COMPOUND

Haymanite creates substantial savings in time and materials . . . not only during installation, but while in actual service.

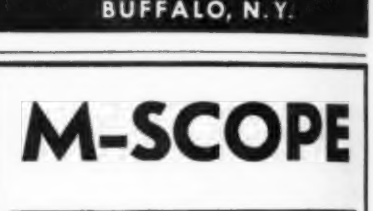
- Each lb. does the work of 4 lbs. of lead.
- No caulking.
- Large bell holes eliminated.
- Easily applied by ordinary workmen.
- No other materials used.
- Permanent.
- Withstands vibration without leaking.
- Self-sealing when broken.

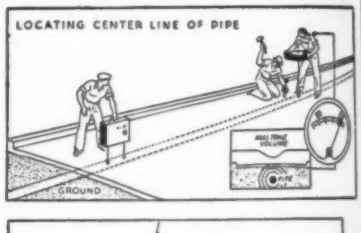
Immediate deliveries from stock. Free, illustrated catalog on request.

Producers also of M. H. Brand Caulking Lead.

MICHAEL HAYMAN & CO.,
INCORPORATED
ESTABLISHED 1869
870 EAST FERRY ST.
BUFFALO, N.Y.

M-SCOPE





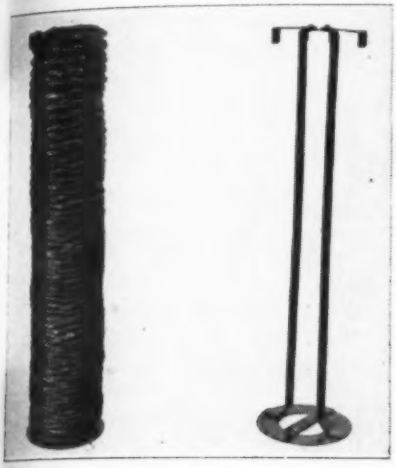
BURIED PIPE AND CABLE FINDER

16 PAGE BOOKLET FREE UPON REQUEST

FISHER RESEARCH LABORATORY
Palo Alto, California

Handy Carrier for Retractable Tubing

The Warner Brothers Company, Spiratube Div., of Bridgeport, has announced the development of a combination carrier and stowage rack for convenient handling of retractable tubing and for storing it while not in use. This retractable tubing, known as Spiratube, is a flexible tubing for the handling of air, gases and various powdered, granular and other light solids.

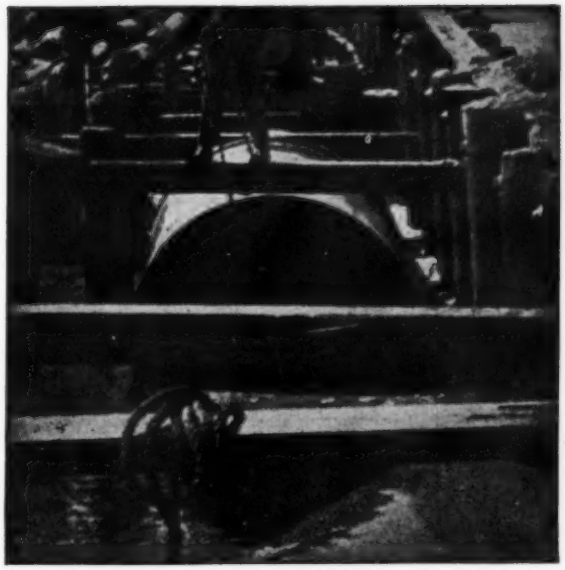


The rack, called "Spira-Tote," comes in various sizes to accommodate various lengths and diameters of Spiratube. The tubing, which is noncollapsible in operation, is easily piled on the rack and locked into position. Many lengths of Spiratube can be compactly, orderly and easily stowed on trucks. The amount of retractability averages about 8 to 1. For example, a 10-foot section of 3-inch Spiratube can be retracted to 24 inches.

Further information on this handy carrier for retractable tubing may be obtained from Frederick K. Daggett, Sales Manager, Dept. 38, 325 Lafayette Street, Bridgeport 1, Conn.

New Indicator for Alkalinity Titration

To overcome the weaknesses of methyl orange as an indicator in acid-alkalinity titrations, Trutest Laboratories, Inc. has developed a new indicator known as M-E-P Indicator. With a color change from green on the alkaline side to an intermediate gray, then to a definite purple on the acid side and vice versa. The indicator is not affected by organic matter or phosphates in solution. M-E-P Indicator is obtainable in various size bottles from Trutest Laboratories, Inc., 261 So. Third St., Philadelphia, Pa.



84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

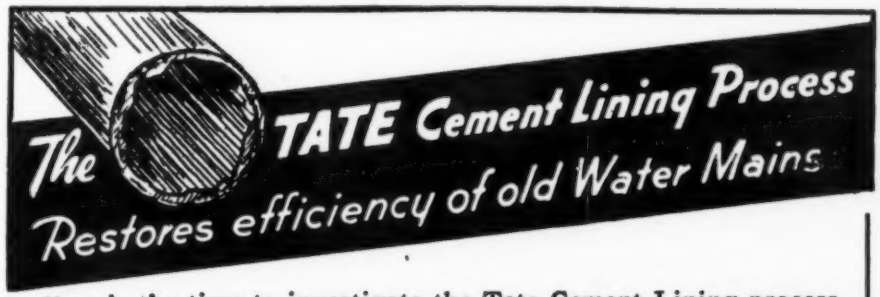
CAST IRON PIPE

SIZES 2" TO 84"

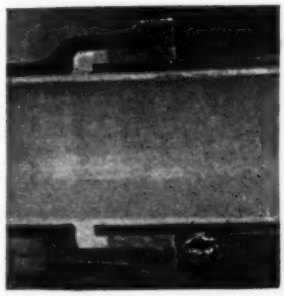
Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.



Now is the time to investigate the Tate Cement Lining process —and see what it can do to restore the efficiency of your old water mains.



View showing Tate Process in Pipe Joint. Note thoroughness of Lining.

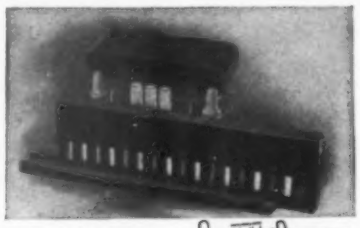
Write for Literature.

What the TATE Process accomplishes

1. Water mains cleaned and cement-lined without removing pipe.
2. Eliminates discoloration and further cleaning costs.
3. Reduces pumping costs.
4. Restores reduction in head and flow co-efficients. This means full fire protection and lowered insurance rates.
5. All joints cement-lined . . . just one continuous pipe.
6. Does the job without interruption of service to consumer.

TATE PIPE LININGS, Inc.

ANDOVER, MASS.



Taylor Model T-O pH Comparator. Slides available to cover range pH 0.2 to 13.6

Simplify...

Speed Up your pH and Chlorine testing this way!

With Taylor Comparators you can make accurate pH or chlorine determinations in *sixty seconds*. Sets are small, light, durable, completely portable and inexpensive. All liquid Color Standards carry AN UNLIMITED GUARANTEE AGAINST FADING. One or two Taylor outfits such as the one illustrated above for pH, the Taylor-Enslow Slide Chlorimeter for chlorine or the Water Analyzer for determining pH, chlorine, color, manganese, copper, fluoride, etc. are all that are necessary for any water or sewage plant. Whatever your needs . . . there's a Taylor Outfit to do the job.

THIS BOOK GIVES SOLUTIONS TO MANY PROBLEMS

A REFERENCE BOOK—FREE. Pages 12, 13, 16, 17, 32, 38 *through* 41, 47 *through* 49, 58, 60 *through* 62 *and* 66 *through* 74 *of "Modern pH and Chlorine Control" are of particular interest to sewerage and water works men . . . give specific recommendations and procedures. See your dealer today, or write direct to*

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AERO-MIX

AERATOR—MIXER

A Size and Type to Fit Your Problem in Water or Sewage Treatment.

WRITE FOR INFORMATION

LITERATURE AND CATALOGS

Water Works Test Set

In a four page folder, Guy Northrop has given a description and pictures of the **Northrop Water Works Test Set,** the only complete test set for hydrant flows, pressure, and loss of head. Also shown in the folder are the hydrant pressure gage for tapped hydrant cap, a faucet gage, and hydrant flow gage with hand pitot, as well as a hydrant flow gage with combination hand and clamp pitot.

This folder describing and showing these various pieces of equipment for measuring flows may be obtained by writing Northrop & Co., Inc., 50 Church St., New York 7, N. Y.

Silicates in Water Treatment

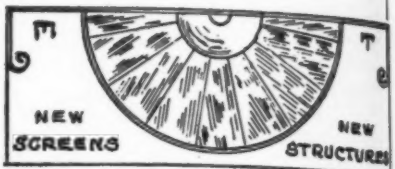
In the Sept. issue of *Water & Sewage Works* there appeared the first of three articles on the use of activated silica in the coagulation of water. It is interesting to note therefore, that in the Sept. number of **Silicate P's & Q's** the entire space is given over to a discussion of the use of activated silica in preparing water for use in a paper mill. This particular story originally appeared in longer form in *Paper Trade Journal.* The original article written by L. L. Klinger, chemist at the Consolidated Water Power and Paper Co. at Wisconsin Rapids explained how by the use of activated silica (3 ppm.) the color of the water and the silica content of the water were reduced, coagulation improved, the pH range of treatment broadened, and the amount of alum required decreased.

Silicate P's & Q's which often contains interesting information on water treatment may be obtained by writing the Philadelphia Quartz Co., 121 S. Third St., Philadelphia 6, Pa.

Plug and Gate Valves in Sewage Plants

The American Car and Foundry Co., makers of a. c. f. lubricated plug valves, has reprinted an article by E. A. Locke, Ass't Engr. in Charge at the Hartford Metropolitan District Sewage Plant. The article which was originally pre-

FINE SCREENS
FOR
SEWAGE
AND
INDUSTRIAL WASTES
TREATMENT



FORMER CONCEPTIONS COMPLETELY OUTMODED

NO COSTLY, POWER CONSUMING REVOLVING BRUSH ARMS—25% GREATER SUBMERGED AREA.

NEW SCREEN PLATES FOR THE ECONOMICAL USE OF A FILTER MEDIA ON THE SCREEN, THUS INSURING GREATER REMOVALS THAN POSSIBLE HITHERTO.

COMPLETELY AUTOMATIC CONTROL POSITIVE SEAL RINGS.

MODERN DESIGN
HIGHEST EFFICIENCIES
LOWEST COST

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2843 WHITEWOOD AVE.
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DESIGNERS — CONSULTANTS

WESTON

GASKET AND FORM
The Perfected Method for Making Sewer Pipe Joints of Cement

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

L. A. WESTON Adams, Mass.

THE *Phipps & Bird* LABORATORY MIXER . . .

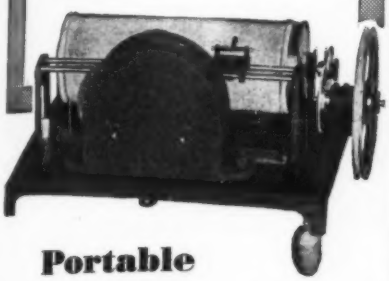
IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

PHIPPS & BIRD, INC. Richmond, Va.

L&S

STEVENS WATER LEVEL RECORDER

Type F



Portable Inexpensive Popular

The Stevens *Type F* Recorder is an inexpensive general utility recorder for daily or weekly service, unlimited in range. *Type F* is particularly suited for securing ground water levels in deep wells; for stream gaging, irrigation, domestic water supplies, sewerage; and for use with weirs, Parshall flumes, Venturi tubes, or any other type of measuring device in which heights, or the differences in heights, are an index of flow.

Type F has a removable chart drum; 8-day clock with abundant power; charts—both English and metric are available . . . Maybe this simple recorder is just what you need. Ask for Bulletin No. 24—and judge for yourself.

LEUPOLD & STEVENS INSTRUMENTS

Manufacturers since 1907

PORTLAND 13, OREGON

Hydrographic • Surveying • Navigation Automatic Controls

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4445 N. E. Glisan St., Portland 13, Oregon

Please send Bulletin No. 24 on the Stevens *Type F* Recorder.

Name _____

Organization _____

Title _____

Street _____

City _____ *Zone* _____ *State* _____

sented before the New England Sewage Works Assn. and later published by *Water Works and Sewerage* was titled "Lubricated Plug Valves Versus Gate Valves at Sewage Plants."

Actually the article is not an argument for or against either type of valve, but contains a description of each as well as the locations in sewage plants where each type has been found advantageous. Comments on the operation of each type of valve are also presented by the author.

If you are confronted with valve operation problems in sewage plants this article may be of considerable help to you. Write the American Car and Foundry Co., Valve Dept., 30 Church St., New York 8, N. Y.

Streamlined Bulletins for Streamlined Valves

R-S Products Corp., Valve Division, Philadelphia, has introduced a new streamlined direct mail type of bulletin, consisting of a mailing card on which is described one product. The July 1946 **Simplicity** bulletin described the New Positive Shut-off R-S Streamlined Butterfly Valve. If you want to be put on the mailing list for these simplified bulletins, write R-S Products Corp., Valve Division, Philadelphia 44, Pa.

Demineralization

In an 8-page pamphlet, The American Cyanamid Co. tells how the **Filt-R-Stil Delivers Drinking Water from Brackish Water.** The pamphlet describes the installation at David, Ky., and by means of text and diagrams shows how the Filt-R-Stil works. Photos of permanent, temporary, or transient units are shown, and the mechanical and chemical theories involved are explained by schematic diagrams.

Copies of the pamphlet are available from the American Cyanamid Co. Ion Exchange Products Dept., 30 Rockefeller Plaza, New York 20, N.Y.

Package Type Power Plant

The Worthington "Package Type" Steam Turbine Generator Power Plant "provides an electrical generating station having features of portability, compactness, simplicity of design and operation, rapidity of assembly and disassembly, and adaptability to a wide range of climatic conditions and variations of

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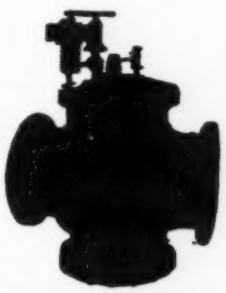
ALTITUDE VALVES • SURGE • RELIEF • BACK PRESSURE VALVES

FLOAT VALVES • REDUCING AND REGULATING VALVES

ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs, hydraulic control.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.
4. Can be equipped with electric and manual controls.

COMBINATION VALVE
This valve will permit flow in one or both directions acting as
1. Pressure Reducing and Relief Valve.
2. Pressure Reducing and Altitude Valve.
3. Relief and Altitude Valve.



REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

ROSS VALVE MFG. CO.
INCORPORATED
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For Maximum Utilization of the Filtering Area

P.F.T. Rotary Distributors provide a practical, efficient unit for dosing sewage to filter medium, in minimum area and with minimum piping. Operate at minimum head, frequently eliminating piping. Features include patented spreader jets that assure full, even coverage of the filter bed; triple valves and a positive mercury seal. Ask for Bulletin No. 213.

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MR. SUPT:—

Sure! You can superchlorinate and avoid high residual chlorine taste when—

you post-treat with Virginia's "ESOTOO".

Write us today.

VIRGINIA SMELTING COMPANY
WEST NORFOLK, VIRGINIA

fuel and water supply." So says the introductory paragraph of Bulletin No. WK-1099-B50 of the above title.

The bulletin contains descriptive matter and photographs of steam generating equipment, turbine generator, condensing unit, feed water assembly, circulating water cooling equipment, switchgear, transformer, piping and wiring, turbine room crane, fuel and ash handling equipment, as well as general data and diagrams of layouts and operating flow sheet.

These "package type" power plants are obtainable in capacities of 500, 1000 and 2000 KW. The electrical and mechanical equipment are coordinated in ten functional units as described above.

This Bulletin, No. WP-1099-B50 may be obtained by writing the Worthington Pump and Machinery Corp., Harrison, N. J.

Binders Complete?

In the July-August issue of the **Yeomans Guard** one of the items is headed "Binders Complete?" This particular item refers to the publications and bulletins of the Yeomans Brothers Co. and asks if interested parties have all of these bulletins: 6651 — Package Aerifier Plants, 6601 — Spiraflo Aerators, 6503—Reaction Type Rotary Distributors and Dosing Siphons, 6552—Water Wheel Distributor, 4302—Package and SEC Type Pneumatic Ejectors, 4500—Transporter Pneumatic Ejector, 8003—Wet Pit Ejector, and Drawings SE 188 and 189—Rim Drive Clarifier Installations.

Write Yeomans Brothers Co., 1431 N. Dayton St., Chicago 22, Ill., for copies of these bulletins if you need them or for a copy of the Yeomans Guard if you're interested in a short article on Porto Rico's Long Range Sanitary Improvement Plan.

Motors and Generators

Sometimes we slip up. It seems we have done so in not mentioning heretofore the many catalogs on motors and generators manufactured by the Century Electric Co., St. Louis, Mo. The best way we know to make amends is to list the whole "flock" in order that our readers may take their pick. Of course, we can't go into detail on what each one contains, but undoubtedly you can get an idea as to whether or not you want one or all of these catalogs: **Century Motors and Generators,** a summary; **Split**

LEADITE
The Pioneer Self-Caulking Material for C.I. Pipe

4 REASONS why more miles of cast iron water mains are jointed with LEADITE than with any other melted self-caulking material:

- MELTS EASILY
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- SAVES TIME, LABOR COST OF MATERIAL
- MAKES A GOOD TIGHT JOINT THAT IMPROVES WITH AGE!

THE LEADITE COMPANY
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No Caulking

FOR BETTER pH Control and WATER TESTS
there is nothing like

NON-FADING GLASS COLOR STANDARDS

Pocket Comparator No. 605

Permanent reliability of Hellige Glass Color Standards, accuracy of color comparison, simplicity of the technique, and compactness of the apparatus are exclusive features of Hellige Comparators not found in any similar outfits.

WRITE FOR BULLETIN No. 602

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INCORPORATED
3718 NORTHERN BLVD., LONG ISLAND CITY 1, N.Y.
HEADQUARTERS FOR COLORIMETRIC APPARATUS

LOW COST
DEMINERALIZED
WATER

WILL REPLACE EXPENSIVE DISTILLED WATER IN THE MAJORITY OF APPLICATIONS

★ Demineralized Water suitable for many requirements demanding distilled water, can now be obtained at a fractional part of the cost of distillation. Belco deliveries are surprisingly rapid.

MODERNIZE YOUR ZEOLITE WATER SOFTENERS

The new Belco zeolite will increase the capacity of industrial softeners up to six times as much. Ideally suited for modernization of present equipment. Belco engineers are always available to help you.

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CHECK WITH BELCO...first!

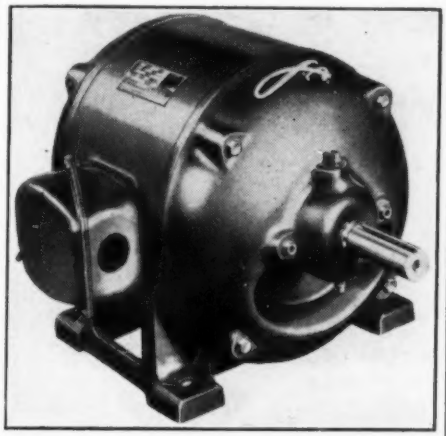
Belco
INDUSTRIAL PROCESSING EQUIPMENT
SINCE 1892

Phase Motor; Squirrel Cage Induction Polyphase Motors, from 1/6 to 600 hp., Form J design; **Totally Enclosed Fan Cooled Motors,** Squirrel Cage Induction; **Slip Ring Induction Polyphase Motors,** 1 to 350 hp.; **Direct Current Motors,** 1/6 to 300 hp.; **Generators, Motor Generator Sets,** alternating and direct current; and in case you are interested there is the **Explosion Proof Motor,** Class 1, Group C, for ethyl ether vapor applications (that one should be good in the digestion control buildings in sewage plants).

Write to the Century Electric Co., St. Louis 3, Mo., for any or all of these catalogs and further information.

Squirrel Cage Induction Motors

It takes a 12-page bulletin to present the **Type OG Standard Squirrel Cage Induction Motor** as produced by the Louis Allis Co. of Milwaukee. This Bull. No. 720 gives the many features of the motor, and by means of photographs and accompanying description and discussion,

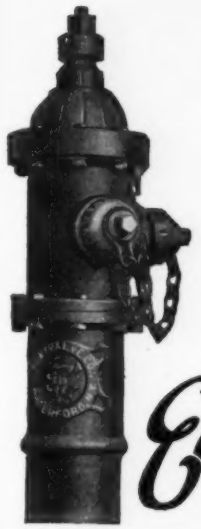


the bulletin shows the construction of the motor, the laboratory work back of it, and its testing and operation. Two pages are given over to pictures of typical applications including pressure blowers, close coupled hydraulic pumps, and multistage centrifugal pumps.

Bull. No. 720 may be obtained by writing to the Louis Allis Co., Milwaukee 7, Wis.

Chemical Feed Systems

The Milton Roy Co., Philadelphia, has recently issued Bulletin No. 468 on **Controlled Volume Chemical Feeders and Automatic Chemical Feed Systems.** The four page bulletin contains discussions on automatic proportioning and ratio con-



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NO digging; no special wrenches; no water can escape in case of damage to standpipe; stem set at bottom of valve means bending by accident won't hurt it; no freezing due to positive drip action; no complicated mechanism, one man can remove entire valve and stem easily, quickly; no water hammer, valve closes against pressure with cut-off under valve; large waterway; and—every single part made with extreme care to last a lifetime and longer. Choice of many water works men and fire chiefs.

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WATERFORD, NEW YORK

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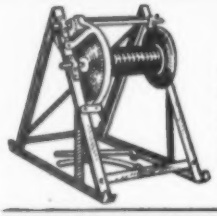
PIPE CLEANING
PROBLEMS SOLVED



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frame. Gear ratio, 5½ to 1. Cable drum holds 1100 ft. Sturdy angle iron of ⅜" cable. Shipping weight without cable 250 lbs.

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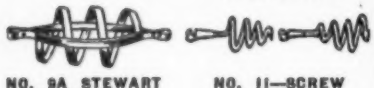

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NO. 11—SCREW
NO. 22—SPEAR SCREW

For information write for catalog.
Canadian Distributors: W. H. Cunningham & Hill Ltd., Toronto.

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HYDRO-TITE

HYDRO-TITE—the self-caulking joint compound that makes cast iron water pipe joints—strong—tight—flexible and everlasting. Used on thousands of miles of pipe with a record of more than 30 years without a failure.

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FIBREX—The sanitary paper packing that is used like braided jute. Free from bacteria—treated with a water repellent—put up in 60 pound reels. 70 pounds of Fibrex takes the place of 100 pounds of braided jute.

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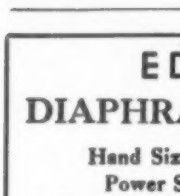

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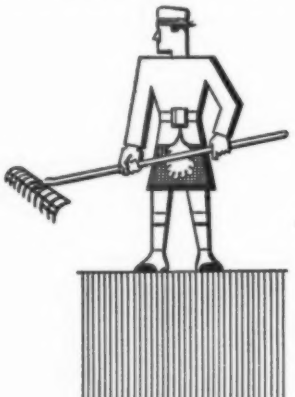

"POWER-SAVER"
TRASH RACKS and RAKES

The latest and best in water controlling apparatus. 1. The improved Rodney Hunt POWER-SAVER Trash Rack, with welded Back Bar Construction. Strong, easy to clean, quick to install, protected against corrosion. 2. Rodney Hunt's POWER-SAVER Buoyant Trash Rakes, with non-corrosive stainless steel heads, and the new "Feather-lite" tubular handle. Almost effortless operation. For the complete story—

Write today for Bulletins Nos. WCA-146 and WCA-147

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118 Lake St. Orange, Mass., U. S. A.

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DIAPHRAGM PUMPS

Hand Sizes 2", 2½", 3", 4"
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Open Discharge or Force Pump
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REPAIR and SAVE
Water Meter
Measuring Chambers
with the
MEMPHIS SLOT INSERT
of stainless steel with new bronze thrust roller.
For further information and *free* ⅝" samples
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trol systems, automatic pH control, automatic control by temperature, pressure, conductivity, or liquid level as particularly applied to the operation of controlled volume chemical pumps. Several figures illustrate the text and the discussions. The bulletin also mentions three technical papers, Nos. 51, 54, and 55, on the application of automatic control to chemical feed and waste disposal.

We can think of several hundred water and sewage works as well as industrial waste treatment plants that should be interested in this bulletin. Write Milton Roy Co., 1300 Mermaid Ave., Philadelphia 18, Pa.

BOND-O in Spanish

No doubt few of our readers can read Spanish and yet it should be of interest to many to know that several manufacturers are printing their literature in Spanish for exportation to the Latin-American countries. One of the most recent of these is Northrop and Co., which has published a four page folder on **Bond-O**, the sulphur cement for making tight water joints. This is a translation of a similar folder in English which explains how to pour Bond-O joints and the equipment necessary.

The item is being issued by Northrop and Co., Inc., through W. P. Iverson & Co., Export Managers, 11 Broadway, New York 4, N. Y.

Over the Spillway

Not to be confused with "The Spillway—the overflow from the main section of *Water and Sewage Works*"—**Over the Spillway** is a mimeographed publication released by the Division of Sanitary Engineering of the Illinois Department of Public Health. Edited by W. J. Downer, Asst. Chief San. Engr. and L. D. Hudson, Principal San. Engr., this bulletin is designed to bring to the operator general information on current happenings in the field as well as basic information of technical nature.

In the No. 1 issue for 1946, there appears one section devoted to Chlorination Terminology and another written by J. T. Barnhill on pH. The former will be slightly out of date when the new AWWA Manual on Water Quality Control is published, but the latter is a very simplified approach to a more difficult topic. It should be of great help to operators.

Perhaps some extra copies of *Over the Spillway* are available. Write

C. W. Klassen, Chief Sanitary Engineer, Ill. State Dept. of Public Health, Springfield, Illinois.

Stream Pollution

We were not surprised to see in the September issue of **The Ladle** an article on "Stream Pollution in the United States," by John K. Hoskins, Asst. Surgeon General and Chief, Sanitary Engineering Division, U. S. Public Health Service. No, we were not surprised because we are well aware that the Master Plumbers are as interested in stream pollution abatement as are we. *The Ladle,* as official publication of the N. Y. State Assn. of Master Plumbers, has long recognized this crying need in the nation.

Adm. Hoskins' article is short and pertinent; it reviews briefly the growth of sewer systems and of sewage treatment in this country, and discusses briefly the type and degree of treatment available and necessary to different conditions.

Among other things, Adm. Hoskins points out that in 1942, 71,000,000 persons were contributing sewage to the nation's streams. This sewage included the untreated wastes from 29,000,000 persons and the partially treated wastes from 42,000,000 others. The total is equivalent to the raw sewage discharge from 47,000,000 persons. In addition, the industrial waste load is equivalent to at least 60,000,000 persons.

While much is being done to alleviate this situation, and while many states have undertaken abatement programs, the U. S. Public Health Service favors the enactment of suitable Federal legislation to help insure the success of the nationwide effort.

The Ladle is published by the N. Y. State Assn. of Master Plumbers, 70 E. 45th St., New York 17, N. Y.

Midwest Research

The Midwest Research Institute of Kansas City has published a report of its first year's work in a reprint from *Chemical and Engineering News,* titled **Research Progress at Midwest Research Institute.** A non-profit scientific organization serving principally the area between the Mississippi River and the Rocky Mountains, the Midwest Research Institute has undertaken 30 research projects since Jan. 1945. These projects include several in each of the

MAIN-LINE METERS

WITH this instrument on your wall you know just how the main-line is functioning though the Sparling meterhead is miles away! It often saves its cost in the first year of operation.

Bulletin 309 comes at your request.

R. W. SPARLING

Manufacturer of Water Measuring Equipment

LOS ANGELES • CINCINNATI
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FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

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INSTALLATIONS WORLD WIDE — LARGEST CITY TO SMALLEST VILLAGE

VALVES COMPLETE EQUIPMENT FOR WATER WORKS FILTRATION AND SEWAGE DISPOSAL PLANTS of LATEST "COREY TYPE" HYDRANTS

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General Offices:
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Sulphur Joint Compound

Our BETTER BLENDING means that each batch of BOND-O comes out of our machines exactly compounded and thoroughly mixed. Cast iron pipe joints made with BOND-O show this difference. Less initial leakage from every joint made.

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GATE VALVE OPERATION

★ SAFE ★ RELIABLE ★ QUICK ★

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The Dean Truck Mounted Valve Operator

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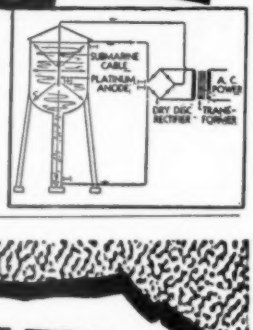
PAYNE DEAN & CO. P.O. Box 271 MADISON, CONN.

RUSTA RESTOR *Keeps Tanks in Continuous Service*

Modern Proved Cathodic Method Provides Lasting Protection Against Rusting — Eliminates Both the Loss of Service, and Cost, of Interior Painting.

Engineered to the individual tank and water conditions Rusta Restor, the modern, cathodic method, maintains the tank in a "neutralized" state that not only prevents rusting but also removes the products of any earlier rusting. Approved and endorsed by national and state authorities. Inexpensive to install. Operation costs two mills ($0.002) per year per sq. ft. of surface protected.



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AMERICAN GAS BOILERS

STEAM AND WATER TYPES

for Digester Heating

FOR RATINGS AND DATA SEE OUR PAGE IN THE 1946 ANNUAL REFERENCE SECTION

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SALES OFFICES IN PRINCIPAL CITIES

AMERICAN-Standard

HEATING PLUMBING

Serving the Nations' Health and Comfort

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

KNOWN AROUND THE WORLD AS THE SIGN OF EXCELLENCE IN WATER TREATMENT EQUIPMENT

The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

GRAVITY FILTERS • SOFTENING PLANTS AND EQUIPMENT • PRESSURE FILTERS ZEOLITE SOFTENERS • SWIMMING POOL RECIRCULATING APPARATUS SPECIAL WATER TREATMENT EQUIPMENT

We invite your inquiries

ROBERTS FILTER MANUFACTURING COMPANY • *Darby, Pa.*

categories: Agricultural Chemistry, Inorganic Chemistry, Organic Chemistry, Applied Physics, and Chemical Engineering.

One study of interest to our readers was devoted to the mechanism of hot water corrosion of metals. Conducted for the Coleman Co. of Wichita, this study is to serve as a basis for the selection of materials to meet corrosive conditions in hot water systems and develop improved design and fabrication methods for hot water heater tanks.

A copy of this reprint may be obtained from Carl Berry, Midwest Research Institute, 4049 Pennsylvania, Kansas City 2, Missouri.

WANTED—MANUFACTURERS AGENTS

Expanded operations of long-established nationally-known manufacturer present unusual opportunity for manufacturers' representatives in several desirable territories, in the sewage treatment, water purification and pumping equipment fields. Your application will be held strictest confidence. Write or contact.

HENRY H. TEPLITZ
ADVERTISING AGENCY
185 N. WABASH AVE.,CHICAGO 1, ILL.

AGENTS WANTED

Long-established manufacturer, with good reputation and substantial annual sales volume, has some exclusive territories open for efficient representatives interested in handling a choice line of chlorine feeding apparatus, filters, etc. All replies confidential. Address Box 2013 Water & Sewage Works, 22 W. Maple Street, Chicago 10, Ill.

NOTICE OF PURCHASE
WATER SOFTENING PLANT
LIME TREATMENT EQUIPMENT
HURON, SOUTH DAKOTA

Sealed proposals will be received at the Office of M. F. Walt, City Auditor, of Huron, South Dakota, until 7:30 P.M. (CST) on the 14th day of October, 1946, for furnishing the Lime Treatment Equipment for the New Water Softening Plant for Huron, South Dakota, as listed below:

PRIMARY SEDIMENTATION TANK EQUIPMENT—1 Required
A mechancial clarifier collecter for the Primary Sedimenation Tank of approximately 3,000 sq. ft. area, min. depth 10 ft. for max. flow of 4,200 GPM. of Raw River Water. The min. retention at 3,500 GPM. rate will be 65 minutes.

FLASHMIX TANK EQUIPMENT—2 Required
Each mechanical Flash Mixer for mixing Milk of Lime in max. flow of 2,100 GPM. Settled Raw Water.

FLOCCULATION TANK EQUIPMENT—2 Required
Each mechanical Flocculator for flocculation of precipitants for a max. flow 2,100 GPM., min. area 1,100 sq. ft. and min. depth 11 ft. Min. retention at 2,100 GPM. rate will be 45 minutes.

CLARIFICATION TANK EQUIPMENT—2 Required
Each mechanical clarifier collector for approx. 3,000 sq. ft. and min. depth 11 ft. for a max. flow of 2,100 GPM. Min. retention at 2,100 GPM. rate will be 120 minutes.

FLOCCULATION NO. 2 EQUIPMENT—1 Required
A mechanical Flocculator for mixing an iron salt and flocculation of the Softened Water after recarbonization for a maximum flow of 4,200 GPM. in a Tank 14 ft. wide x 42 ft. long x 14 ft. water depth.

All bids to be submitted on forms furnished by the Engineer, which may be obtained upon request. State Law requires a five (5%) per cent certified check with bid.

E. H. Dunmire
Consulting Engineer
2774 South Street
Lincoln, Nebraska

CITY of Huron, South Dakota
Harry M. Liem, Mayor
M. F. Walt, Auditor

TOWNSHIP OF HAMILTON
COUNTY OF MERCER
STATE OF NEW JERSEY

ADVERTISEMENT FOR THE SALE OF FILTRATION EQUIPMENT

SEALED BIDS will be received by the Township Committee of the Township of Hamilton, in the County of Mercer, New Jersey, at the Municipal Building, 2090 Greenwood Avenue in said Township of Hamilton, Mercer County, New Jersey, until 8:00 o'clock P.M., Eastern Standard Time, November 19, 1946, and then publicly opened and read for the sale of:

SLUDGE FILTRATION EQUIPMENT

This equipment has never been used and is in new condition. It is complete for handling digested sludge from a 4.5 mgd. sprinkling filter plant, including filter drum six (6') feet diameter by eight (8') feet long and all necessary compressors, conveyors, pumps, tanks and etc.

This equipment is to be sold to the highest bidder in place at the Township of Hamilton Sewage Treatment Plant. The right is reserved to reject any and all bids.

For further particulars concerning same, address Frank A. Priest, Township Clerk, 2090 Greenwood Avenue, Trenton, 9, New Jersey.

By order of the Township Committee.

FRANK A. PRIEST,
TOWNSHIP CLERK.

NOTICE OF PURCHASE
STORM WATER PIPE
HURON, SOUTH DAKOTA

Sealed proposals will be received at the Office of M. F. Walt, City Auditor, of Huron, South Dakota, until 7:30 P.M. (CST) on the 14th day of October, 1946, for furnishing Storm Water Pipe of Vitrified Clay, Concrete or Corrugated Metal, f.o.b. Huron, South Dakota.

Approximate Requirements are:

3170 feet of 36" diam.
2336 feet of 30" diam.
7343 feet of 24" diam.
4851 feet of 18" diam.
9576 feet of 15" diam.

All bids to be submitted on forms furnished by the Engineer, which may be obtained upon request. State Law requires a five (5%) per cent certified check with bid.

E. H. Dunmire
Consulting Engineer
2774 South Street
Lincoln, Nebraska

CITY of Huron, South Dakota
Harry M. Liem, Mayor
M. F. Walt, Auditor

FOR SALE

11,100 ft., more or less, of 12-inch "universal" cast iron pipe, collar and sleeve joint (bolted, not welded).

170 ft., more or less, of 6-inch cast iron "bell and spigot" pipe

4—6" gate valves.

4—6" check valves.

2—Centrifugal pumps, frg. 345,520 gpm. at 231 ft. head, Goulds, with 50 hp. Louis Allis, squirrel cage, Type EX, Class IE, 220-440 volt electric motors attached.

2—Motor starters.

2—Pump houses 11'6"x15'6".

1—Job lot, electric wiring (short lengths).

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2925 Mansfield Road
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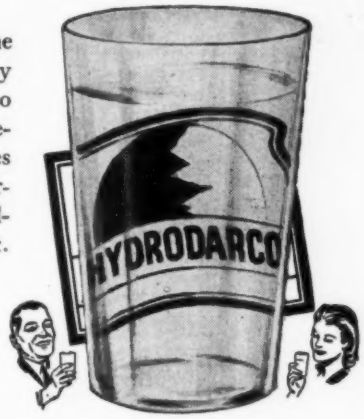
GOOD WATER MAKES SATISFIED CUSTOMERS

You can win and hold the good will of your public by standardizing on Hydrodarco for water purification. This special activated carbon eliminates odors and bad-tasting impurities with absolute dependability at surprisingly low cost.



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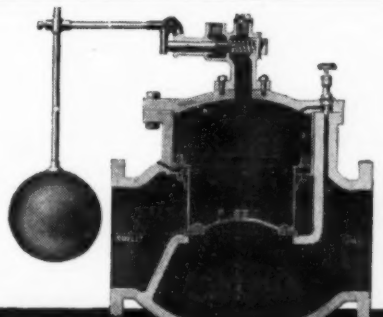

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HIGH PRESSURE
COLD WATER
Float VALVES

Available in standard sizes from 3 inch to 36 inch, in Angle and Globe Patterns—iron, semi-steel, and cast steel bodies with non-corrosive trim of bronze, Gavalloy or Stainless steel.

100-page descriptive Catalog, free on request.

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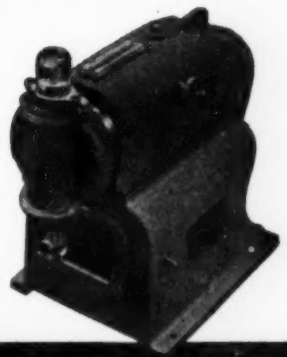

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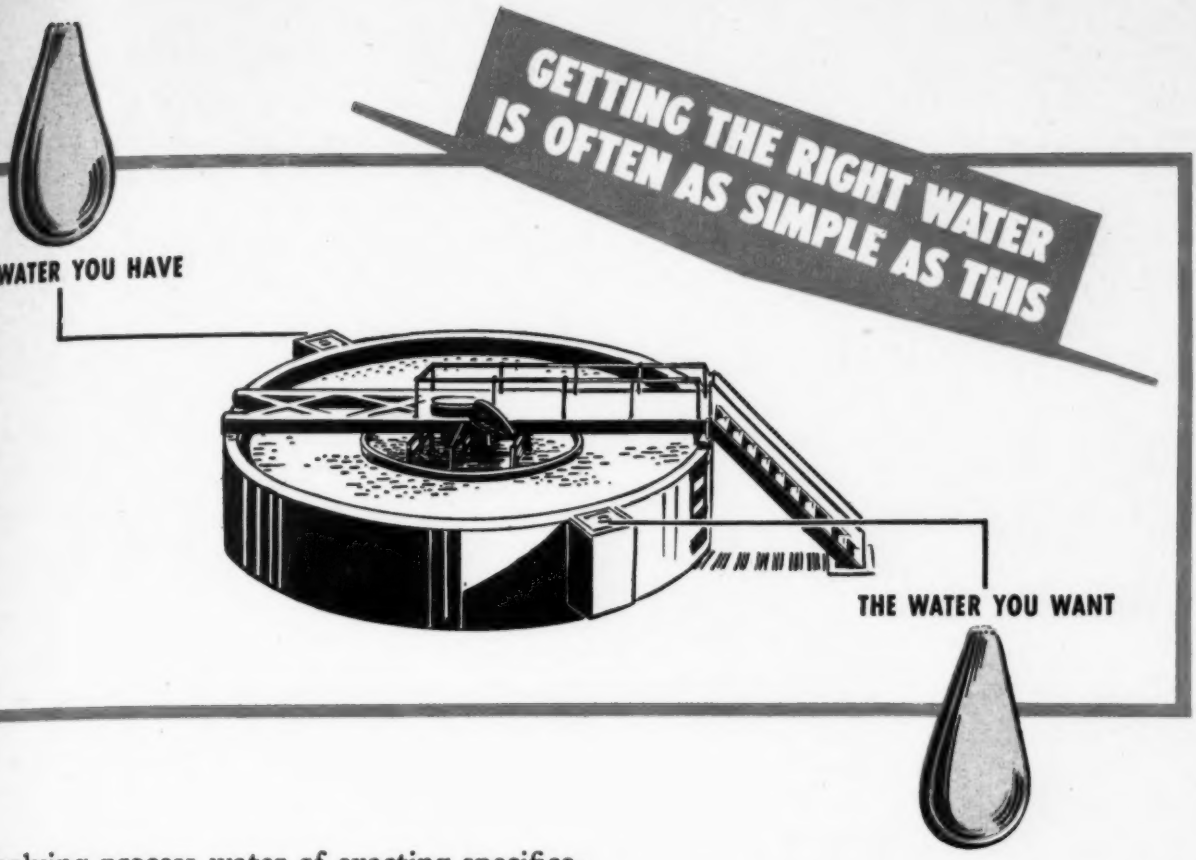

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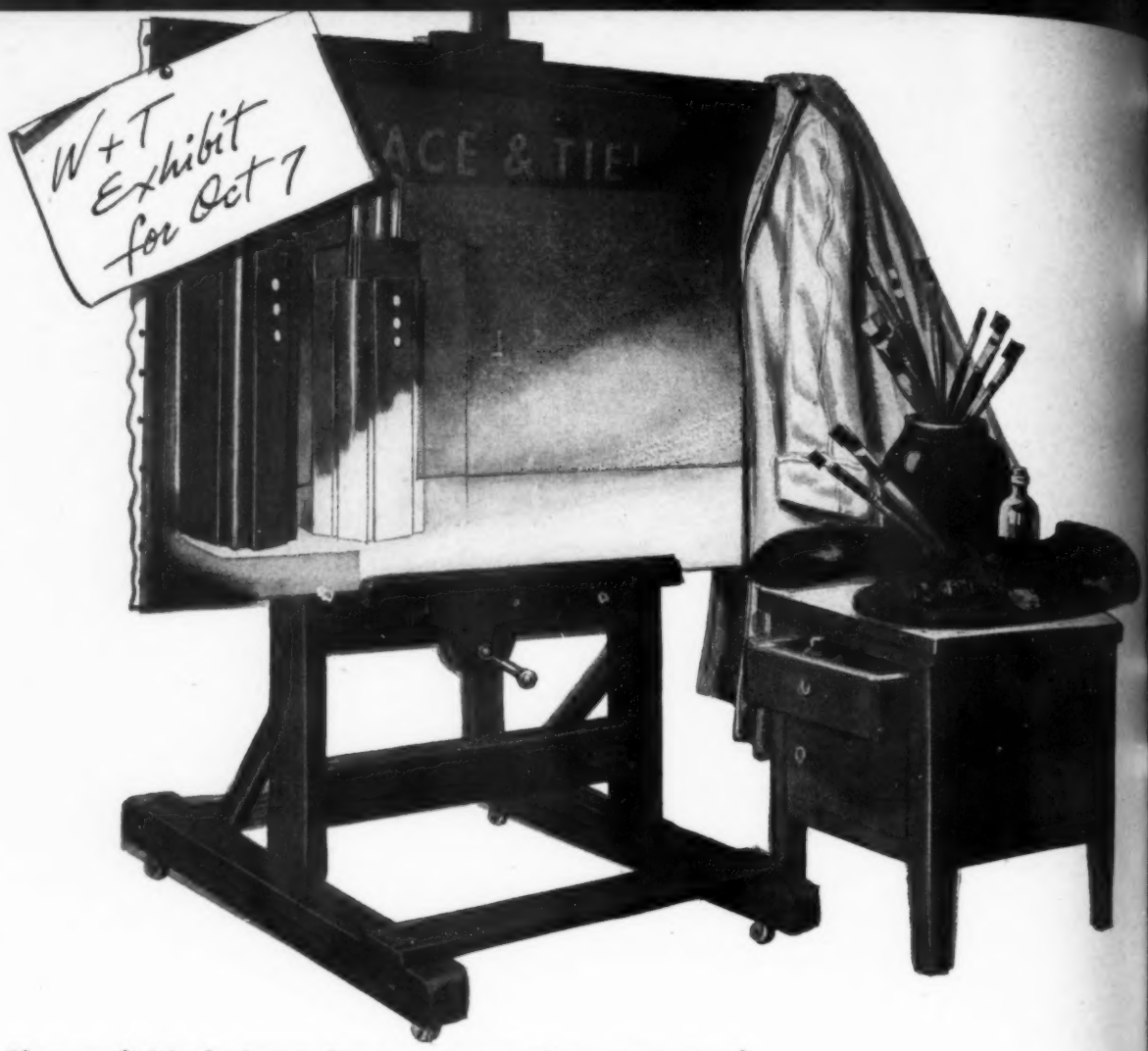

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